LIBRARY RECEIVED AUG 22 1898 SMITHSONIAN DEPOSIT. 39196

THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXIX.—No. 8. Whole No. 1,211. | NEW YORK, MONDAY, AUGUST 22, 1898. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 32 Pine Street, New York.

Collections are invariably made directly from this office for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, £4.50 (19 shillings—22½ francs). All payments to be made in advance. Single copies, 10 cents.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

Remittances should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. We would suggest to our patrons that to avoid the risk and expense consequent on sending us the money (we do not send books C. O. D.), that orders for books be sent us through the Purchasing Department of the American Express Company.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS

An Asterisk (*) denotes an illustrated article.

EDITORIALS—

Briefly Told 261

Activity in the Gas Trade—Comparison of Cost and Maintenance of Small Gas and Electric Motors—Notes.

The Growing Importance of the Storage Battery 262

Sixth Annual Meeting, Pacific Coast Gas Association—Official Report—Revised by the Secretary—Continued from page 234 262

First, Day, Afternoon Session—*An Efficient Oil Heater, by Mr. E. C. Jones—Discussion—Gas Coke for Generator Fuel, by Mr. C. M. Converse—Discussion—*Some Possibilities with an Electric Lighting Plant, by Mr. C. O. Poole—Discussion.

Slag Bricks in Germany 270

Coal in the East 271

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 272

Something from Binghamton, N.Y.—Contract for the Western Gas Construction Company—Possible Change in Ownership, Quincy, Ills.—Public Lighting, Somerville, Mass.—Death of Mr. R. A. Stranahan—The Waukegan (Ills.) Plant will be Built—Natural Gas Rates, Erie, Pa.—New Office Quarters for the Aurora (Ills.) Company—Main Extensions, Santa Rosa, Cal.—Gas Works for Mason City, Iowa—Quibbling at Frankfort, Ky.—An Explosion of Acetylene Gas—Fourth of July Illumination, Seattle, Wash.—The Calumet Company, of Chicago, Sells Its Electric Properties—New Gas Rates, Williamsport, Pa.—And Other Items.

Crystallized Calcium Metal 273

The Market for Gas Securities 273

BRIEFLY TOLD.

ACTIVITY IN THE GAS TRADE.—The developments of the past spring and present summer, in connection with the advance and growth of the American gas industry, are little short of wonderful. In the early spring the troubling look of the international situation caused a halt in the matter of going on with proposed plant betterments at many points, but April was not at its end before the tide of extension and reconstruction was flooding the gas works construction shops with orders, the average magnitude of which had not been exceeded for a decade. In two divisions of the construction line this activity was notably manifest—in the instances, respectively, of enlarged storage capacity and of extended distributing facilities. Nor was this activity confined or restricted especially to any section of the country, for the movement was in evidence, in some shape or manner, in every division of the States. Of course, the adding of generating capacity was also marked, but the greatest developments in construction work were undoubtedly in the storage and distributing sections. For instance, since March 1st, to our knowledge holders to the number of 29 have been bargained for—the maximum to retain 5,000,000 cubic feet, the minimum to hold 12,000. In the main extension section we have records showing the placing, at 91 different locations, of 398 miles of pipe, in which compilation no pipe less than 3 inches in diameter is included. The main laying compilation also dates from March 1st. The maximum pipe work example stands for 8.2 miles—of an average diameter of 4 inches—and the minimum example stands for ¼ mile of 6-inch. Our figures for the output for the first half of 1898, as compared with the output for the first half of 1897 (we have in hand returns from 58 points) show thus far a gain for the current year of something over 11 per cent. Another striking feature of the building section of the industry is that the inquiries on such account for prices from constructors show no falling off. On the whole, those interested in any way in the gas industry have much cause for satisfaction over its present standing, and have equal reason for scanning the outlook with complacency.

COMPARISON OF COST AND MAINTENANCE OF SMALL GAS AND ELECTRIC MOTORS.—Anything related to this subject must have much of interest for gas men, so a *resume* of an article thereon, which appeared in the *Jour. für Gasbeleuchtung*, dated July 5th, will appeal to our readers. The writer, having briefly recapitulated the advantages of the gas engine for small manufacturing establishments and purposes, admits that the electric motor unquestionably brings, in addition to the advantages of the gas motor, a number of desirable features. It requires less room, is started and stopped in the most simple manner by a turn of the hand, requires very little outlay in respect of attention or lubricants, and its first cost is much smaller than that of a gas engine; but when the question of economy in cost of operating and maintaining is considered the favor is all with the gas engine. Although the charges for electric current, when used for power purposes, are usually very much reduced as against the charge for current used for illumination, it is nevertheless susceptible of proof that, for steady working, the gas engine is cheaper on the whole by more than 50 per cent.; and even when employed but half the time the gas engine will still effect a saving of 40 per

cent., under the conditions which are given later on by the author. These conditions cover the cost of each machine or apparatus, gas and current, attendance and other necessaries as at present obtaining in Cologne, Germany. In the comparative table it is assumed that both motors shall be run during 10 hours each day for 300 days in the year, when at full work. The gas engine is assumed to be of the Otto type, of the latest "Deutz" construction, the electric motor is taken to represent the best example of such apparatus, and both are to be of 4 horse power. The gas engine requires 91.8 cubic feet of gas per hour, and the electric motor is to absorb 3.8 kilowatts per hour. In each case interest on capital is reckoned at 4 per cent., and wear and tear is estimated at 7 per cent.:

Gas Motor.

Cost of plant	2,300	marks.
Interest, wear and tear	253	"
Cost of gas, at 10 pfennigs per cubic meter	780	"
Oil and waste	125	"
Attendance and cleaning	102	"
Total cost per annum	1,260	"

Electric Motor.

Cost of plant	1,400	marks.
Interest, wear and tear	154	"
Cost of current, at 22 pfennigs per kilowatt hour	2,508	"
Oil and waste	52	"
Attendance and cleaning	36	"
Total cost per annum	2,750	"

From this it will be seen that the cost per horse power is 10.5 pfennigs for the gas motor and 23 pfennigs for the electric motor. In a similar manner is shown the comparative cost where the motors are used only one-half the time. In such instance the conditions become more favorable to the electric motor; but even then the economy is still 40 per cent. in favor of the gas engine. It is true, however, that the less the motors are used the nearer will the electric motor approach the gas engine in economy of operation. We have purposely not translated the German into American values in order that unavoidable (even though very small) discrepancies, which occur when turning these foreign values into cubic feet, dollars and cents, should not lead to any misunderstanding of the main points in the above tables, which otherwise are plain enough.

NOTES.—At a meeting of the shareholders of the General Electric Company, held in Schenectady, N. Y., last Wednesday, it was voted to reduce the capital stock to $20,827,200, to consist of 182,760 shares of common stock (par value, $100 each), and 25,512 shares preferred stock of like par value. The decrease amounts to two-fifths of the former capitalization.——Notice has been given of the incorporation of the United States Nomatch Light Company, which has been organized under the laws of the State of Virginia, with a capital of $500,000. Its officers are: Directors, Thomas Adams, Jr., Jno. S. Levis, P. J. Carlin, Dr. A. Simonini, F. V. Strauss, H. M. Adams, Percy G. Williams, Louis R. Adams and Henry Rowley; President, Thomas Adams, Jr.; Vice-President, Percy G. Williams; Treasurer, Henry Rowley; Secretary, John S. Levis.——The City Council of Tallahassee, Florida, has under consideration an ordinance providing for the erection of an electric light plant, to be operated on municipal account. The ordinance comes up for final action at Council's hands at its first meeting in September. Should Council indorse the plan, the measure will then have to be voted upon by the taxpayers.——The City Council of Dallas, Texas, is endeavoring to have it declared that the franchise of the Dallas Gas and Fuel Company has expired. The subsequent scheme is to offer the right to operate a gas works in Dallas at public auction, the money so received to be applied to repaving the streets.

The Growing Importance of the Storage Battery.

In a paper read before the Engineers' Club of Philadelphia, Joseph Appleton states that in the history of the electrical industry in the United States there is probably no branch which has shown such a rapid growth as in the case of the storage battery during the last three years. The following figures show the enormous increase during this time; they have been carefully compiled and represent the actual weight of storage battery plates installed. The weight is that of plates alone and does not include containing cells, acids, etc.:

1894	349,000	pounds,
1895	1,112,800	"
1896	3,315,300	"
1897	3,607,300	"

[OFFICIAL REPORT—REVISED BY THE SECRETARY—Continued from Page 235.]

SIXTH ANNUAL MEETING, PACIFIC COAST GAS ASSOCIATION.

HELD AT SAN FRANCISCO, CAL., JULY 19 AND 20, 1898.

FIRST DAY.—AFTERNOON SESSION.

The President introduced Mr. E. C. Jones, of San Francisco, who read the following paper on

AN EFFICIENT OIL HEATER.

The heating of petroleum, or any of its distillates, previous to using it as an enricher for water gas, is acknowledged to be a necessity. For many years this preheating was imperfectly done, with the result that much of the oil which should have been made into gas was converted into both lampblack and oil tar.

Crude petroleum is composed of many different oils, each one of which leaves the liquid state to become vapor and then a hydrocarbon gas at different temperatures, some very low and others very high.

For instance: A sample of Peruvian petroleum does not begin to give off any distillate until the oil has reached a temperature of 302° F., and between that and 392° F. 49.3 per cent. of its volume passes over as vapor, while one of our California distillates gives off 40.3 per cent. of its volume under 302° F., and 52.1 per cent. below 392° F.

From this it will be readily seen that in the last instance the light distillates which come off from the oil at comparatively low temperatures must be treated in a different manner from those which go off at temperatures ranging from 500° to 600°. Should this light oil be treated in the same manner, and simultaneously with the heavier oils, the result would be a decomposition and destruction of the most valuable portions of the oil.

A complete fractional distillation of a given sample of oil at once points out the remedy, which is that the lighter portions shall be heated, together with the heavier portions, at a temperature which will not destroy any of the oil. This will permit the lighter oils, upon entering the superheater, to at once become hydrocarbon gas, while the heavier oils are sluggishly treated by the more intense heat, and all that is not coke residue, or too heavy to be made into gas, passes off in a fixed form surrounded and protected by the water gas.

The preheating of petroleum may be likened to the cooking of a thick steak. Should the steak be thrown at once upon the top of glowing coals the result would be an immediate coating of the outside of charred meat or charcoal, which would then ignite, while inside of this coating the meat would be in its original raw state; but by gradually heating the meat every portion of it is evenly cooked, and it may be so regulated that all of the steak will be equally well done or equally rare.

The writer has had varied experiences with the different devices for heating oil, with little success. These devices included jacketed steam pipes, the use of exhaust as well as live steam, oil heating pipes surrounding the down-take pipe from the superheater, as well as oil pipes contained within the down-take pipe, and in each instance serious difficulties have been encountered.

In some instances the amount of heat present that can be applied to heating the oil is inversely as the amount of heat required for heating the oil.

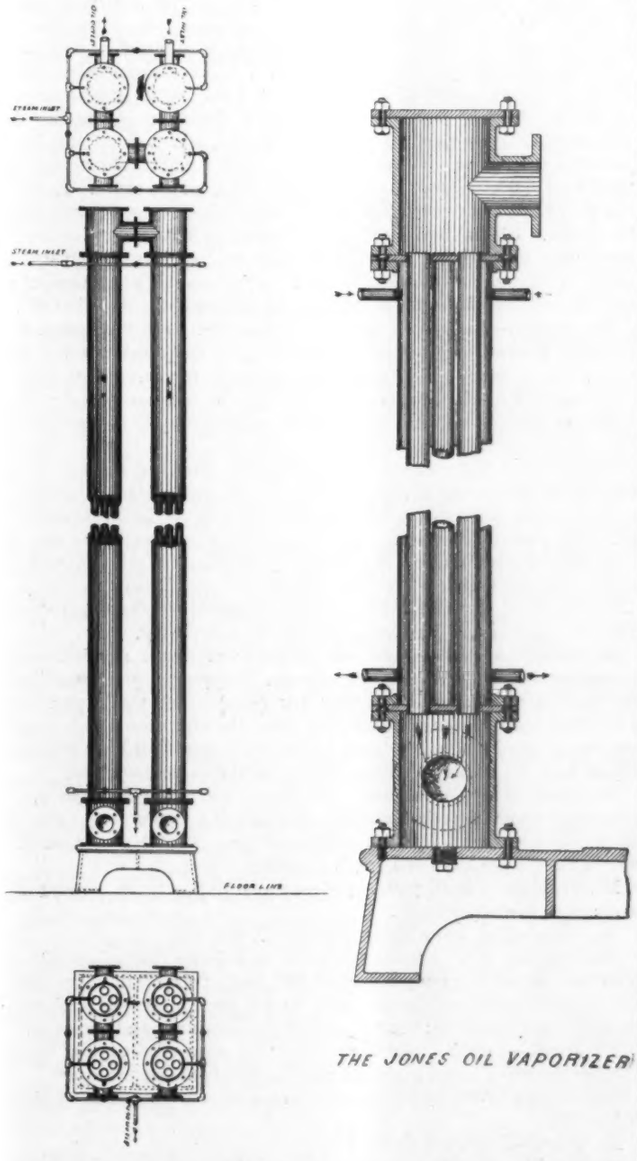
After the North Beach Station at San Francisco was completed the oil heaters that were installed with the plant were supposed to be as good as anything then known, and we had entire confidence that the results of their working would be satisfactory. After gas had been made for some days we found difficulty in heating the oil sufficiently to prevent its running down through the fire into the ashpit. This may bring a smile to those who have never had this experience; but it was ours, and it was ours to remedy. Yet the remedy was not in sight. Still this necessity became the mother of the oil heater which we are now using.

A description of the oil heater may not be out of place, although the accompanying diagrams will almost explain themselves and demonstrate the simplicity and cheapness of construction of this heater, and a day's use will demonstrate its efficiency.

At the North Beach Station the heater consists of four 8 inch wrought iron pipes, something less than 20 feet long. At each end of this pipe is screwed a faced flange. On these flanges, top and bottom, is a tube sheet, into which are expanded four 2-inch boiler tubes, 20 feet in length. Fastened to these tube sheets, top and bottom, are cast iron

tees with side outlets, and the tees are so connected at top and bottom that they are all in regular sequence; that is, oil passing in at the top into one tee passes down through the 2-inch tubes into the tee at the bottom, passes over and up through another series of tubes, then down and up again, after which it is conveyed through carefully covered pipes to the superheaters.

Just below the flanges at the top of the heater is the steam inlet. Live steam pipes are connected to each of the inch pipes surrounding



THE JONES OIL VAPORIZER.

the boiler tubes, and at the bottom is the outlet for carrying off condensed steam.

In constructing the heater great care must be taken to insure tight joints between the tube sheets and the flange, and the tube sheets and the tees above and below them. The diagram shows a special bolt with a countersunk ring in the middle of it for drawing the tube sheet down to the flange at the top and bottom of the 8-inch pipes, leaving a stud end for bolting on the tees.

This, however, may be dispensed with by making the joint between the tube sheet and the flange and drawing it up with short bolts. The tubes may then be expanded in place, and these short bolts removed without breaking the joint. Then the joint between the tube sheet and tee may be made and the whole drawn together with bolts of a proper length.

Both of these joints should be made with copper rings shaped in section like an I-beam. With this copper ring should be used a thick mixture of black oxide of manganese with shellac. For thinning this mixture alcohol is used. The commercial black oxide of manganese is not fine enough for this purpose, and it is well to have it reground in a paint mill before using.

These joints are absolutely oil and vapor tight, and great care should be used in making them, as it is both expensive and troublesome to remake them after the heater has been put in use. In every case a drip should be provided at the lowest point of the heater, so that the oil may be drained back to the oil tank by gravity, if possible.

At the North Beach Station the charging floor of the generator room, where the heater is placed, is at such an elevation that steam is taken from the top of the boiler to the top of the oil heater, and a return pipe from the bottom of the heater passes to the blower pipe of the boiler, and the heater is used without a steam trap. Where this is not possible a small steam trap may be connected to the outlet steam pipe.

The outside of the 8-inch pipes, as well as all of the cast iron tees, should be thickly covered with a non-conducting coating of sufficient thickness to prevent much if any loss by radiation.

The heater thus described has successfully heated both crude oil and distillates for two 12-foot generators, making 1,000,000 feet of gas each per 24 hours, but, of course, running alternately.

An important advantage of this heater, which sets perpendicularly, is the small floor space which it occupies, and the fact that, if it is not sufficiently large, it may be added to at any time without reconstruction by bolting on one or more additional upright parts.

In a heater recently made for the Potrero Station, it was found of advantage to place seven 2-inch tubes, instead of four, in each 8-inch upright pipe. This materially increases the capacity of the heater without increasing its size.

A description of the working of the first oil heater made on this plan may be of some interest.

The steam pressure at the top of the heater was 100 lbs., which has a temperature of 327.9° F., and with this temperature excellent results have been obtained, and it seems as though an additional heat added to the steam in the boiler would add unproportionally to the expense of heating it.

For instance, if 100 pounds steam has a temperature of 327.9° F., 200 pounds steam has a temperature of 381.7 F. While the pressure is doubled, the temperature of the steam had only been increased 53.8° F. This does not refer in any way to methods of superheating steam after it has left the boiler.

During December, 1897, a test was made of the first oil heater in use at North Beach Station, with the following results: The test covered three runs, two of which were of 10 minutes and one of 9 minutes duration. The temperature of the oil as it left the heater was taken at the beginning of each minute. The steam pressure was 100 pounds; temperature, 327.9° F. The total amount of oil (distillate) used for the three runs was 279 gallons; gas made per run, 18,750 cubic feet; oil used per 1,000 feet, 4.96 gallons; amount of water condensed from the steam used in the heater (for three runs), 24 gallons. Temperature of condensed water drawn from the heater, 212° F.

The temperature of the oil leaving the heater is given in the following table:

Time.	First Run.		Second Run.		Third Run.	
Minutes.	Degs. C.	Degs. F.	Degs. C.	Degs. F.	Degs. C.	Degs. F.
1	105	221.0	119	246.2	113	235.4
2	115	239.0	131	267.8	128	262.4
3	130	266.0	143	289.4	138	280.4
4	141	285.8	147	296.6	145	293.0
5	143	289.4	141	285.8	146	294.8
6	141	285.8	136	276.8	144	291.2
7	138	280.4	130	266.0	141	285.8
8	137	278.6	127	260.6	139	282.2
9	136	276.8	125	257.0	137	278.6
10	135	275.0	..	..	135	275.0

The average temperature of the oil for the three runs was 273.2° F., or 54.7° F. less than the temperature of the steam. In the construction of later heaters this difference has been narrowed down so that the oil upon leaving the heater is within a few degrees of the steam temperature.

Another form of this heater which, however, has not been tried, but would seem to possess some advantages, may be made by placing the 8-inch pipes horizontally, the tees being connected at alternate ends so that the oil passes through the heater in regular sequence as in the perpendicular heater.

In this style of heater the oil would pass in at the bottom and the steam at the top, so that the oil would be gradually heated by coming in contact with the pipes where the steam is at its lowest temperature

and pass out at the top in contact with pipes heated to the highest temperature of the steam.

The temperatures at which some of the oils used in California begin to give off distillates are as follows: Coalinga oil, from Fresno county, 158° F.; Pacific Coast Oil Company's distillate, 212° F.; Ventura crude, 212° F.; Los Angeles crude, 482° F.

One cargo of Peruvian crude petroleum began to distill over at 302° F. It will be seen by the above that some of the California oils do not begin to vaporize until a temperature has been obtained exceeding that of 100 pounds steam, while some of the lighter oils distill over as much as 42½ per cent. of their volumes at and below the temperature of 100 pounds steam.

The oil heater which has been described in the foregoing paper is not covered by letters patent, and the writer presents it to the gas fraternity as a little contribution which may make some gas man's path smoother and prove a benefit in a pecuniary way to his company.

Discussion.

The President—Will Mr. Guldlin open the discussion on the paper just read?

Mr. Guldlin—It is rather difficult to discuss a paper that presents a definite design with definite results. However, I understand Mr. Jones has largely increased the heating surface in his heaters since the first time they were introduced in the North Beach Station, and at the same time I also understand it is used for the oils which do not distill at a temperature attained by 100 pounds of steam. Now my observations in the operation of water gas plants lead me to believe it is not necessary in an oil heater to produce a temperature that would distil the oil to obtain the best results. In fact, I think if you attain such a temperature, where you are dealing with part distillate and part solid oil, you are rather uncertain about the distribution of your oil in your superheater. We have in our apparatus obtained the best result when we heated the oil to a temperature not higher than can be attained by exhaust steam, so that we can always rely on distributing the oil in a liquid form, depending on the mechanical distribution of the oil more than the distribution of the vapors. I noted that Mr. Jones has increased the number of tubes from four to seven. That was done with a view, I presume, of increasing the percentage of vapor obtained in the heater in order to prevent the larger percentage of liquid oil from falling through the fire, and if that was so the experience has been different from ours. Of course in the design of apparatus that I refer to we are not delivering the oil in a generator, so I cannot say what relation that would have to the conditions Mr. Jones stated, but we would naturally have the same result in the bottom of the carbureter. When we heat oil to the temperature of exhaust steam, say from 200° to 212°, we find very little can be gained by turning on live steam on that heater, and from those results we have adhered to the exhaust steam heater. Of course there is a difference between this design and the one I refer to in this respect. We have a vessel that contains from three to four charges of oil, and the exhaust steam is passing through the pipe coil not only while the run is being made but also during the time of the blast, and consequently we are storing up heat for the run. I have made some experiments as to the variation in temperature, but, owing to the size of the vessel we are using, the variations were very slight; that is, they would not range more than 10° to 15°. I would like to ask Mr. Jones about the actual difference in the result in increasing the heating surface from four to seven tubes. I do that, not only on account of this heater, but on account of another question which came up some time ago in the construction of a condenser. We were building a plant and were requested to largely increase the number of the tubes in the condenser, and reduce their diameter. On investigating the subject, which came under my personal work, I found that as a rule the construction of condensers is on a wrong principle if the theories of radiation as adopted in steam heating and other similar applications are correct. In other words. Take a tube like this and surround it by steam and the amount of oil that will pass through that tube will absorb its heat, say from one-third to one-half the length of the tube. Now, if that is true, I cannot see, judging from the capacity of those tubes, what advantage there would be in increasing them, for the simple reason that the cubic contents of those tubes, each 20 feet long and 2 inches in diameter, each one of which would contain, if I remember correctly, about 20 pounds of oil, would have absorbed heat from the steam while the oil was traveling from one-third to one-half the length of the tubes. I brought up that question some time ago and I mention it again for the reason that I would like very much to know what advantage Mr. Jones found in actual operation between the four tubes and the seven tubes, looking at the whole construction as a heat machine. And I would also like to ask what advantage, if any, in the consumption of oil per 1,000 you find in using exhaust steam and live steam?

Mr. Jones—You notice in the temperature of the oil in that first run there was a variation of 54° F., which should not have been. In using four tubes in a vaporizer of this type the cubical contents of those tubes would be about 60 gallons, while a 12-foot generator would use 90 gallons of oil per run of 10 minutes. I found that it would be to our advantage to have the vaporizer or oil heater made large enough to contain enough, and a little in excess, of oil for one run. Seven 2-inch tubes, 20 feet long, will contain about 100 gallons of oil, so that the oil, if we are running one generator, has 10 minutes in which to attain the temperature of 100 pounds steam, which I think is some advantage. There is no reason why the heater cannot be used with exhaust steam as well as with live steam, excepting that, as the heater is used in San Francisco, it is practically a part of our boiler, and it is so carefully protected against loss of heat by radiation that I might safely claim no more heat is taken out of the steam by the oil than is needed. That we can prove by the water (the condensed steam) which we took away from the heater. I have never used exhaust steam in that kind of heater. I have used exhaust steam in an ordinary coil of jacketed pipes, but never in this style of heater, because I did not see the advantage of it and did not have the exhaust steam to put through it. Was that all?

Mr. Guldlin—In exhaust steam heaters, as well as in this heater, the principle generally embodied has been to pass the steam around the tube; that is, passing oil through the tubes by reversing that action and passing the exhaust steam through the tube you have a body of oil to absorb heat in, and you would have an opportunity of storing up heat which you do not have in this.

Mr. Jones—I find there is an advantage in breaking the oil up in passing across the tees at the top of the 8-inch pipe into seven columns and forcing it down through these pipes. It stirs up the oil better, and although I have not experimented much with it it gives better results than with the continuous coil system of preheating the oil. I have had great difficulty with it. To answer your question by the results per 1,000 feet of oil, I will say it was almost impossible for us to get along without this heater. This has filled our bill completely.

Mr. Guldlin—Another point was whether you found any difference in raising the oil to the high temperature. Supposing you were dealing with oil which distills at a very low temperature, would you find any difference in raising the temperature of the oil to one which would convert oil partly to vapor, instead of where it would all be retained in liquid form till the distribution of the oil in the generator itself.

Mr. Jones—There are so many conditions which would come in to offset any benefit that that would be a matter of a year's running of a set of generators, and I might safely say yes. That is based on the amount of oil per 1,000 in a year's running.

Mr. Guldlin—Didn't you experience any difficulty in passing oil through in the vapor form?

Mr. Jones—You mean blowing back? Not as yet.

Mr. Guldlin—No. I mean you have an injector that passes oil in. You heat the oil to a temperature of 300°, part of the oil in vapor form and part in liquid, and the first part would come in vapor, and goes through your injectors; next, liquid oil is following it and comes in.

Mr. Jones.—I don't understand there is a separation of that kind. I know the vapor is not given off until it reaches the superheater.

Mr. Guldlin—And would not interfere with the operation of your injectors?

Mr. Jones—It has not so far.

Mr. Guldlin—In other words, you are holding the oil under such pressure that it is retained in its liquid form, even although it is heated to the temperature stated.

Mr. Jones—We carry 40 pounds pressure on our oil.

Mr. Guldlin—So do we.

Mr. Jones—I find that is much better than 20 pounds. We get better results by increasing the pressure.

Mr. Guldlin—Yes; we also get better results by increasing the pressure. I tried to bring out these points for the reason that we do not aim, in handling oil in water gas apparatus, to attain a temperature higher than will permit us to inject oil in a liquid form—that is, mechanically spraying it—because if we do we are getting an irregular delivery, which will affect the run; and this paper has brought out the question largely, of course, in respect to steam heaters. I fully believe that the proper way of heating oil is by steam; that is, by any method in which you can insure a uniform temperature when you start your machine as well as when you stop it. The other heaters referred to by Mr. Jones as located in the North Beach Station and other places, pre-

sent difficulty by uneven temperature. That is what I understood you to say.

Mr. Aldrich—How long has this been in operation?

Mr. Jones—About 5½ years.

The President—Mr. Adams is using a heater, and we would like to have his experience with it.

Mr. Adams—I have used the down-take heater and the Jones and down-take heaters separately and together. One point I would like to bring out is the drop in temperature between the temperature of the steam and the temperature of the oil. We had a curious accident up at our works about two years ago. We could not get our oil in the carbureter, and, after breaking the connection in these several heaters, I found (just as Mr. Guldlin noted) the oil coming out in shoots. First it would be a shoot and then oil. I did not understand that for a long time, but eventually came to the conclusion that we were getting vapor at one time and oil at another. The first year we worked the heater we got, as near as I could find, a very even temperature; the heat radiating from the shells interfered with the correct reading of the thermometer very much. At that time it gave us somewhere in the neighborhood of 300, the oil coming from the heater. Last winter, in using the Los Angeles crude oil, we had difficulty in getting a certain result, and tested the oil again; 140° was as high as we could ever get it. I have never been able to find out the cause.

Mr. Guldlin—Was not the cause of it that the pipes were coated with soot?

Mr. Adams—I am not talking of the down-take heater, but of the Jones' heater, in conjunction with the heater from the off-take pipe. Strange to say, 140° was the same temperature we could get from this ordinary off-take heater, although the heater from the off take pipe had been running a year. I changed thermometers until I used about 12.

Mr. Guldlin—Did you have any leak or by-pass?

Mr. Adams—No leak at all. I came to the conclusion that we must have baked the oil in some way in the pipes of the several heaters, so that it formed a coat of some kind; but I cannot give the explanation. I am hunting for it now. I hoped you would be able to give it to me.

Mr. Jones—I think Mr. Adams could not have been troubled with spurts of vapor from the Los Angeles oil. I understand it was 16° or 17° oil.

Mr. Adams—At the time these spurts were developed we were using Los Angeles oil mixed with other oils, and the gravity of the mixture was about 30°.

Mr. Jones—That would give off vapor, but the Los Angeles oil does not begin to vaporize until it reaches a temperature of 482° F.

Mr. Adams—10,000°, more like.

Mr. Jones—It is possible that in the use of the Los Angeles oil there might be a caking of carbon on the inside of those pipes which would prevent the passage of heat through them. I think in that event it would be well to clean out the heater.

The President—My experience of the heater in the downtake was, that, in order to carry it on and keep it going properly, we would have to take them out every other day, which was a very great labor. The oil would start in the generator at first at 600° and drop down to about 225° by the time the run was out, and on account of the difficulty of keeping the apparatus in order, the continued burning out of the apparatus, and the time consumed in changing it, I went back to an old steam-heating oil heater, very much on the plan of Mr. Jones, which kept up an average of about 250°; and I may state for the benefit of all concerned, without anything to say against other apparatus, that our results were just as good with that constant heat as they were with the enormous heat which was not maintained, and that is about all there is to say on the subject. I am very much in favor of a steam heater that will maintain the heat somewhere in the neighborhood of between 200° and 300°.

Mr. Guldlin—One point Mr. Jones mentioned about this matter I think that is well worth bringing out, is the fact that the construction permits it to be so placed that the steam can be returned to the boiler without any traps or other contrivances. Isn't that so? There is no question but that the detail and general designs as shown here on these drawings are very carefully studied out, and I think, should make as good a heater of the principle on which it is designed as possibly could be made. I want to say this in connection with my former remarks, that I may not be misunderstood.

The Secretary—I want to add a word to the testimony that has been given about the Jones heater. We are using the ordinary exhaust heater at our works, maintaining an even temperature by it of about 200°. It is rigged so as to take in live steam and can be used, and has been used, as a live steam heater as well, with no appreciable difference in raising the temperature, apparently; but I can see advantages in the Jones heater, and I propose using one in an installation which I am making in Oakland. I can see the benefits that Mr. Guldlin has stated, and I think the thanks of the Association are due to Mr. Jones. We, in a perfunctory way, tender thanks for the reading of papers, which practice I was glad to see so far this session was omitted. But when a man of Mr. Jones' caliber presents to this Association ideas of that kind for our benefit, and tenders the use of them, I think he is entitled to a vote of thanks. So I move a vote of thanks to Mr. Jones for his paper, and for his gift to the gas world of a valuable idea. [Adopted.]

Mr. C. M. Converse, of San Francisco, read the following paper on

GAS COKE FOR GENERATOR FUEL.

Our reasons for abandoning the use of anthracite coal and using our gas coke for fuel in our generators will appear further on; and you will see that it is not from choice, but due to our "Glorious California climate" and the "Spanish atrocities." My object in writing this paper is to tell you of our difficulties in learning how to use this fuel and how we overcame them, hoping that our experiences may be of some benefit to those of our members who may be placed in like circumstances.

To our Eastern brethren who have Penn, Westmoreland or Youghiogheny coal, this may seem a very simple proposition; but there is coke and coke, and the hard, clean coke from Youghiogheny coal is quite different from that made from a mixture of South Prairie, Vancouver and East Greta.

For the first week or 10 days after we began using coke in our generators we experienced no serious difficulties. To be sure, we had some very hard fires to clean, still we were getting along fairly well; but finally our make per run began to grow smaller and smaller, our oil and fuel account grew larger and larger, and the clinker harder and harder. Never before have I seen such clinkers. We rammed and jammed and d——d, but the clinker only grew larger and harder, until we were compelled to fire up our second generator and draw the fire in the first one, in which the clinker had formed an arch about 18 inches thick and over 8 feet in diameter.

It was a great pleasure to me to show this to our chief engineer, as I had my doubts as to whether he had ever seen any real clinkers before. I was convinced that he had not; I'll not repeat his remarks. They reminded me, however, of the story of the lady who, being asked how her husband opened a can of peaches, replied that, judging from the sounds from the kitchen, he opened it with prayer.

I thought for a while that he was going to order us to surrender; instead he called a council of war and we decided to try using just as little anthracite coal as possible, spreading a thin layer between each layer of coke. But this was not all satisfactory, for unless we used from 30 to 33⅓ per cent. of coal we could see no benefit over using all coke.

There was one item, however, in favor of this experiment which we might take advantage of "when this cruel war is over," if we ever go back to using Welsh anthracite coal, and that is this: When we were using all anthracite we were compelled to screen it, and the amount of slack in Swansea coal is very great—sometimes as high as 40 to 50 per cent. We can save all this when used with coke, as we use the coal unscreened.

But we did not want to use *any* of our anthracite at this time, so another council was called and we came to the conclusion that to a great degree the cause of this dreadful clinker was due to our blasting too long and too heavily. When using anthracite coal alone our custom was to blast about 10 minutes under 9 inches pressure, but the coke fires (which we carry as deep as the generator will allow) being so much freer, the long, heavy blast caused the ash to fuse into this hard clinker; so we reduced our pressure and shortened the time of our runs to 6 minutes' blast, 6 minutes' steam-and-oil, and 3 minutes' steam alone, and slice or clean our fires after every 6 to 8 runs. We have been running in this manner for several weeks quite satisfactorily.

The domestic anthracite coals of Pennsylvania and Colorado are among the best in the world, yet the high transcontinental freight rate makes the use of these coals in California prohibitive, and we are obliged to use foreign anthracite coals or coke from poor, domestic bituminous coal for making coke for generator use.

The present shortness of anthracite coal in this market is due to several causes. A season of rain in California means prosperity and plenty, and as wheat is our principal export, foreign vessels bring us coal at almost ballast freight in order that they may have return cargoes of wheat.

Owing to the past dry season the wheat crop in California is very light and will require but few vessels for its shipment. The miners'

strike in the Welsh colleries has also affected the shipment of Welsh anthracite coal. This, together with the fact that our country is involved in war, in which coal is a contraband of war, leaves us upon our own resources, and you all know that the Yankee gas man is never so happy as when in trouble and left to his wits to get out of it.

Discussion.

Mr. Adams—I would like to ask Mr. Converse what percentage of increase in fuel the coke gave him over the anthracite?

Mr. Converse—We are now using about 45 pounds of coke, including boiler fuel.

Mr. Rice—We are so situated in the southern part of the State (the Los Angeles Gas Company getting about the only cargo of Welsh anthracite that comes into that part of the State) that we, the smaller gas companies, have been forced to use an inferior material. Mr. Converse has spoken about the domestic coal of Colorado and New Mexico being a very good sort, and I quite agree with him, with the exception that in our apparatus clinkers form very badly. At the same time there is domestic coke in Colorado, which we are getting from Trinidad, and I found that this coke with these coals in some way seems to neutralize the iron and sulphur in the coal, and we can run half and half mixed much better than with coal alone.

Mr. Gregory—I understand that coke has not been used in connection with Welsh anthracite, but I have used coke for the purpose of cleaning the fire, when employing Welsh anthracite for taking the gas out of the oil, and it worked first rate. I have used English coke, but the ordinary coke is satisfactory.

The President—Mr. Britton has had considerable experience in this line.

Mr. Britton—Mr. Converse uses the ordinary gas house coke from bituminous coals, such as South Prairie, Hetton, or any other bituminous coals employed in the manufacture of coal gas. I have had experience with coke and coal in our generators for three months. First, I used one-tenth coke, gradually increasing the proportion until now I employ 50 per cent. of each, with no bad results whatever so far as clinker is concerned, and with no appreciable increase in generator fuel, pound for pound. I cannot tell how much for boiler fuel and combined, because my boiler fuel is composed of coke screenings, oil tar, ashes and every other combustible stuff that can be picked up around gas works. This question, however, is an interesting one to everybody operating a water gas plant, even though it does depend entirely upon the market price of your coke. If a gas company can sell its coke at a price that will equal the price of an anthracite coal, I do not think it would care to go to the annoyance and trouble that are occasioned by the use of coke entirely. In the "Experience Department," Mr. Clements read an experience which came from me concerning New Mexico coal. I used that New Mexico coal, and it is entirely different from the Colorado, in regard to its effect under blasts and in generator fire. That coal can be laid down here for $12 a ton in any quantity desired, and there is absolutely no loss—not a pound of screenings or breeze comes from that coke. It has no clinker, not even the clinker of the Welsh anthracite coal. Taking the ordinary Welsh anthracite, buying it at the market price and allowing for 50 per cent. decrease in its usefulness as generator fuel, and you increase the price of your coal, together with the annoyance of clinkering, stopping of runs, etc., to a price that very nearly, at the present rates of Welsh anthracite, equals the cost of that New Mexico coal; and I would advise any gas man here to-day, who has any trouble with Welsh anthracite or who cannot get coke at an available price, to experiment as I did with New Mexican coal. I believe if its use could be introduced among the gas men on the Coast there would be no trouble in securing rates from the railroad companies which would bring it almost within the price—taking into the account the loss by screenings and breeze—of Welsh anthracite, for if all the gas companies on the Coast would unite in using that coal it would pay the railroad companies to bring it here at a rate that would enable it to compete with Welsh anthracite. Again, we would not be burdened with two things: First, the laying up of a stock of coal, which is detrimental to our profits; second, we would not experience the annoyance of probably being short of coal. Although there is Welsh coal afloat it is hard to get, and prices are constantly increasing, so everything favors this New Mexican coal. I could not use the Colorado coal. I don't know whether anybody else on the Coast except myself has tried it, but I used about 300 tons of that coal and was the happiest man in the gas business when the last pound of it was gasified. It simply was a case of occasioning wrinkles and gray hairs over those chargeable to any other department of our business. I would like to hear from other water gas men here as to their experience in using gas house coke. Of course, we have all tried patent coke with success, but when the Welsh coal came into use that went out—it was used with Pennsylvania coal, and became a necessity—but on the advent of Welsh anthracite gas house coke was relegated to the past, and I do not think has been used by any company since. The New Mexican coal is not subject to any duty.

Mr. Crockett—One thing has not been brought out very clearly in regard to this question in connection with Mr. Converse's paper. We had a contract for a large quantity of oil—something like 6,000 barrels per month. We had to take the oil and either use it or store it. As our storage capacity was limited we had to use the oil as far as we could. Knowing that strikes were on in the Welsh mines, that war risks, etc., were on, and in addition had been compelled to use a great deal of anthracite coal under our boilers at the electric light station, to do away with the smoke nuisance, we found it necessary to devise some means of filling the gap which would be left by our non-receipt of coal, and while we had between 17,000 and 18,000 tons contracted for, we could not see a possibility of getting any at all. Our stock of coal was something in the neighborhood of from 7,000 to 9,000 tons, which would be a small quantity, as we were using 2,100 tons per month in the electric light station. Therefore, it was necessary for us to devise means by which we could make water gas, use up this oil which we had bought, and in fact to carry on the business in some way. We, therefore, concluded to use this gas house coke. We knew we could not get the same results out of it. We figured on the price we could get for coke and what we would have to pay for anthracite coal, so really we were simply making use of this coke for the purpose of making water gas when we could not afford to use any more anthracite coal. Of the coal that we have contracted for there has not 1 pound been shipped, and the strike is still on. I state this simply to show the difficulties we have to work under occasionally, when we are so far away from the source of supply of raw materials.

The President—Mr. Crockett, is it not a fact, if you had been making that much coke and had not been using it for water gas, that you could not have sold the coke for any price?

Mr. Crockett—We could now sell coke very readily, because the general fuel market is high; but at the same time we could not afford to sell it and keep our stock up.

The President—I have had an experience in using ordinary gas house coke made from Wallsend coal, to the amount of 25 per cent. of the former with 75 per cent. of the latter. Perhaps Mr. C. O. G. Miller, who keeps our accounts, remembers it. We tried it for about a month, only to find that we were simply throwing our coke away. I figured that the length of the blow necessary to bring the anthracite coal to a state of incandescence, sufficient to enable us to split steam into carbonic oxide and hydrogen, was so great that by the time we got the anthracite coal hot the coke had gone into ashes and up the smokestack. That I know to have been the case. I can also say with great certainty that we did use for over a month our own coke entirely by itself, and the only difficulty was the runs were so short that the men were kept jumping all the time. We would blow five minutes and make a run of six minutes, and it was nothing but opening and shutting the valves all the time. Of course there was an increase in cost of fuel; but I don't recall how much, because it was some time ago and when we were running the old generating sets. Since we have been running the United Gas Improvement Company's plant, I can't say what would be the result, but I would not advise anybody, from my own experience, to ever undertake to use Welsh or any other anthracite coal mixed with ordinary gas house coke. I am satisfied by the time they have made the run the coke will have gone up the stack and out in the yard.

Mr. Guldlin—Did you find that more coke than coal was required per 1,000?

The President—Some more; I don't remember how much.

Mr. Guldlin—I asked the question because the general impression seems to be that it does take more coke than coal per 1,000 feet of gas made. This is rather surprising to me, because, in the results obtained in the East, such as I am familiar with, we have invariably secured fully equal results with coke, pound for pound, to those obtained with anthracite, and decidedly so when it comes to Welsh anthracite.

The President—One reason for that perhaps is that in your apparatus you have a much deeper fire than we have. Your fire is 2 feet deeper than it is possible for us to have in our apparatus, which would make a very great difference in respect to using a poor quality of coke. I think Mr. Jones would agree with me in that.

Mr. Jones—Yes. Theoretically I cannot agree with Mr. Guldlin on the amount of coke required in making 1,000 feet of water gas. A

pound of bituminous coal converted into coal gas yields about 60 per cent. by weight of coke. That coke contains all the ash that formerly was in 100 per cent. of coal, and for that reason we get more ash and clinker in our generator. There must be more fixed carbon in a pound of good anthracite coal than there is in a pound of coke.

Mr. Guldlin—That is simply a question of analysis.

Mr. Jones—I based my statement on analyses.

Mr. Guldlin—That is based of course on the carbon that is in the coal?

Mr. Jones—Yes.

Mr. Guldlin—We have obtained results with coke (taking the results covering several months) that I am still hunting for anthracite men to equal, which results were obtained from coke made in the gas works. Certainly one thing which I appreciate is that the treatment of a generator using anthracite coal and one using coke is entirely different, because you take the weight of coal that you have in a generator. Taking anthracite coal as compared with the weight of coke you will have, there is such a great difference that you cannot use either blast, or length of blast, or anything else the same. You take one of your generators here, its fuel depth and blast pressure, and if you blow on coke as you would on anthracite, as the President said, I am afraid you would have to hunt for your coke. In a body of anthracite like that you can give it an amount of steam which you gauge by the opening of your steam valve. If you give the same to a coke fire I am afraid your carbonic acid would be a great deal worse than was the monoxide question here some time ago. As to results, I think it has been thoroughly demonstrated that good gas house coke, reasonably clean, will equal anthracite at any time under proper conditions; and you do not get big clinkers either.

The President—I think we can reconcile Mr. Guldlin's statement and Mr. Jones' experience in this way: Mr. Guldlin is speaking of coke made in Milwaukee, which, unless they have changed since I left there myself, is the product of a Youghiogheny coal, and does not contain more than 2½ to 3 per cent. of ash. On the other hand, Mr. Jones is speaking of coke made from coal that contains from 6 per cent. to 16 per cent. of ash. Consequently I think each of them is right.

Mr. Guldlin—The coke we principally use in the East is made from Pittsburg coal; but I will also say that we have used coke made from Illinois coal, and also from local Iowa coal. I don't think the coke made from the Illinois or Iowa coal is any better than your local cokes; but the results mentioned were obtained from coke made from Pittsburg coal. That coke, however, was taken from the yard where it had been exposed to the weather and contained so much foreign matter that the gas company did not care to sell it to its coke customers. Is there any way by which Mr. Converse could separate the boiler coke and the generator coke, because, in throwing in the boiler coke, there is a very uncertain quantity, which depends on what purpose you are using steam?

Mr. Converse—We never have kept them separate. You mean the weighing?

Mr. Guldlin—The coke used per 1,000 under the boiler.

Mr. Converse—It all goes under the same weight.

Mr. Adams—I would like to ask Mr. Converse how the make of his machine per run for 24 hours compared—whether there was not a decrease of about 30 per cent. on his make during 24 hours?

Mr. Converse—About 20 per cent.

Mr. Adams—If your machine, for instance, would make 20,000 per run, would it make a decreased proportion for 24 hours?

Mr. Converse—When we were using anthracite coal we generally made 21,000 to 22,000 per run, and with the short runs with coke we made from 12,000 to 12,500.

Mr. Adams—I did not mean per run, but for 24 hours.

Mr. Converse—That is a hard question to answer. It depends on how much we make per run. I don't know that I could even answer that.

Mr. Adams—I ask the question because I have had some experience with those special questions in all forms, and I could not with coke used alone obtain more than about 70 per cent. to 80 per cent. of the make on the machine in 24 hours that I could with anthracite coal, although making four and five minute runs.

The discussion having been declared closed, Mr. C. O. Poole, of San Francisco, read the following paper on

SOME POSSIBILITIES WITH AN ELECTRIC LIGHTING PLANT.

To the Pacific Coast Gas Association: In listening to the discussions that took place at the two previous meetings of this Association in relation to electric lighting plants, I was very much impressed with the universal opinion that seemed to prevail among the members that an electric light plant was a very undesirable kind of a thing to have around. Of course, a great deal of this sentiment could be accounted for in the fact that this Association is almost entirely composed of representative gas men, and the Association was formed for the purpose of discussing gas and gas methods. Little wonder is it, then, that when some new method of lighting springs into existence, and some enterprising individual sets up a $10,000 electric lighting plant within a stone's throw of your $100,000 gas plant, that the gas man should look upon the newcomer with distrust and apprehension; and when the electric light is offered to your customers for less than gas rates, you naturally begin to lose them one by one, until you are forced to take heroic measures to protect yourself. The result is that nearly every gas man here to-day is saddled with an electric light plant, as you call it, not by choice but by force of circumstances. But the strangest part of it is, "No one of them is paying," you say; they are simply kept running as a kind of necessary evil. It is the statement that your electric plants did not pay that is responsible for the title of this paper, "Some Possibilities with an Electric Lighting Plant."

When our Secretary asked me to contribute a paper to this meeting I accepted the invitation with the hope that I might say something that would be of service to you in your arduous duties of conducting an electric light plant profitably. If some idea set forth or experience related shall succeed in nothing else than bringing about a full discussion of the subject, I will feel amply repaid for my effort.

To begin with: You must realize and acknowledge to yourself that the electric light has come to stay, and that it will continue to grow in favor in spite of any effort that may be made to hold it back. The strides made in electricity during the past few years have been simply phenomenal, and no one can foretell to what distance the march will reach in the next few years to come. In spite of the Welsbach burner, whose advent was to sound the deathknell of the incandescent electric light, the demand for this method of lighting has continued to grow, at the rate of about 30 per cent. per annum, one year over the other. Conceding, then, that the electric light has become a necessity, and that the demand for it must be satisfied, the present problem is to produce the light as cheaply as possible, so that you may reap at least a fair return on the investment.

The items that go to make up the cost of production are about as follows:

Fixed Charges.—Interest on investment, deterioration and depreciation, taxes, insurance and administration.

Station Operating Expenses.—Fuel, labor, water, oil and waste, and repairs.

It is a fact, as stated in the beginning of this paper, that there are a great many electric light plants in operation that are not paying dividends. In many cases the reason for this can be traced to the fact that cheap, inefficient apparatus had been installed, both in the station and on the circuits. In many small towns on the Coast plants have been installed for the express purpose of selling them, either to the local gas company, who would buy it for self-protection, or to some ambitious individual who has more money than good judgment and no knowledge of the business. In the first case, the gas company carried the plant along and supplied its customers with electric lights when they wouldn't have gas. The plant is looked after in a half-hearted kind of way, and if there are any burdens to be divided between the gas and electric plant the latter usually gets the worst of it. It frequently happens that attendants are not capable of properly taking care of the machinery, and the result is dissatisfaction all around. Is it any wonder that plants are a failure under such conditions?

Steam users on the Pacific Coast are particularly unfortunate in having to pay such high prices for fuel. Coal, for which we pay $6 and $7 a ton, can be had in the Eastern States for about $2. Fuel being the principal item of expense where a plant is using steam power, it behoves the manager of an electric light plant to install the most efficient apparatus to be had. The boilers should be of the modern, water-tube type, capable of carrying high pressures with safety. This style of boiler will cost about $18 per horse power against horizontal tubular boiler at $11 per horse power. The difference in price is about 60 per cent., but this has no terrors when you consider that a saving of about 10 per cent. in fuel can be made on the higher priced boiler. If you burn five tons of $6 coal per day there will be saving of $1,000 per year. At this rate the boiler will soon pay for itself.

The mistake is often made of putting in single cylinder engines, at a price of $8.50 per horse power, when a good compound engine can be had for $11 per horse power, or an increase of 30 per cent.

It is an uncommonly good single cylinder engine that will do a

horse power on less than 36 pounds of steam, while a compound, non-condensing engine will yield a duty of 26 pounds, or an increase in efficiency of 27 per cent. This can ill afford to be lost sight of in the selection of an engine. The prices quoted here are for boilers and engines of about 100 horse power capacity; larger units would be proportionally cheaper. If cooling water can be had conveniently, with a condenser added to the compound engine, it will reduce the steam consumption to about 21 pounds, which means an increased efficiency over the last named conditions of about 15 per cent., and a corresponding increase in the horse power of the boiler and engine.

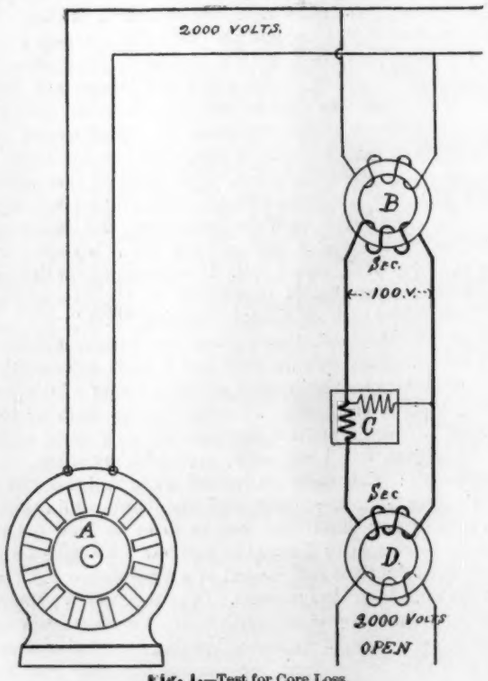


Fig. 1.—Test for Core Loss.

Connecting a condenser to an engine will generally increase the efficiency of the plant about 20 per cent., were it not for the fact that air, and sometimes circulating pumps, must be added, which require steam to run them; and, in small plants, this will amount to about 5 per cent. of the steam used.

Before leaving the subject of boilers and engines, let us consider for a moment what these different efficiencies mean. Assuming that our coal costs $6 per ton laid down in the boiler room, and has an evaporating power of 8 pounds of feed water per pound of coal under actual conditions, then, with the single cylinder, non-condensing engine, 4.5 pounds of coal per horse power hour would be required, while with the compound condensing engine the consumption would only be 2.6 pounds, or a saving in fuel of 42 per cent.; which on a year's run would amount to $4,599. Reverting again to the equipment of our plant, having installed efficient boilers and engines, we next require a generator. Too much care cannot be exercised in selecting this part of the equipment. The first thing to decide is whether or not you will want to run motors on the lighting circuits. If you do you should have a 60-cycle machine. This periodicity is about the best where light and power are to be supplied from the same generator. If lights alone are to be supplied, a little better efficiency can be obtained in the transformers by using 125 cycles. The first cost will also be a little less; but if your lines are to be of very great length the line losses will be a little greater with the 125 cycle than with the 60 cycle, on account of the increased inductance. If the greater part of the load is to be motors, it might be well to use a multiphase system, as this style of motor gives much better satisfaction than the single phase machines; but my belief is that before many years the single phase motor will reach a stage of development that will render the multiphase motor unnecessary. When this is accomplished it will simplify the distribution of light and power by alternating currents wonderfully. Taking everything into consideration, even if you see no present use for motors on your circuits, it would be well to select a 60-cycle machine, for if you ever have a demand for motor power you would be better fitted to supply it. Rotary transformers can be better operated on 60 cycles than on higher frequencies, the speeds being lower and the noise made by the machines is less objectionable.

Where lighting and power are to be supplied from the same circuits, or if lights alone are used, the electromotive force should be about 2,200 volts, transforming to 110 and 220 volts, or a ratio of 20 to 1. At these pressures the line losses are quite reasonable.

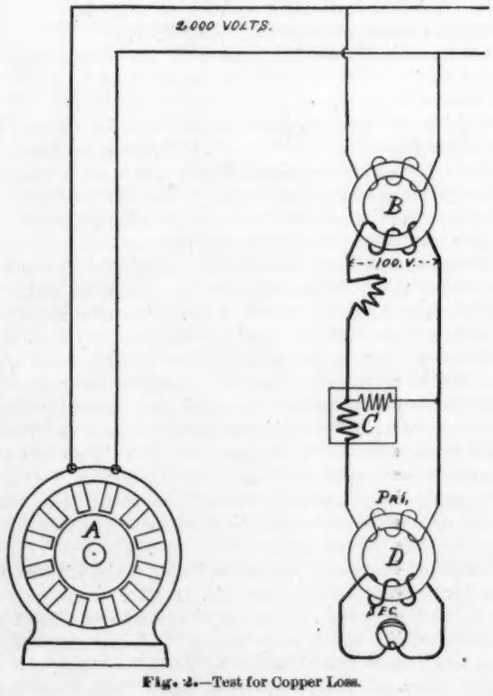


Fig. 2.—Test for Copper Loss.

In constructing the lines good double or triple petticoat insulators should be used, to prevent excessive leakages and short circuits. If the circuits are to be quite long, the wires should not be separated more than about 12 inches, on account of the increased inductance that is occasioned by the separation of the wires. This is quite an important feature, especially where high frequencies are used. For instance, if a circuit of No. 4 B. & S. wires is separated 12 inches the impedance factor at 130 periods would be 1.47, while, with the wires separated 36

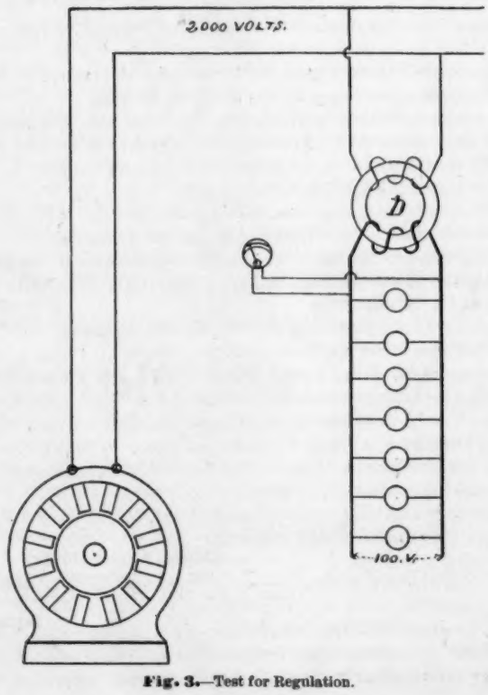


Fig. 3.—Test for Regulation.

inches, the impedance factor is increased to 1.65, or about 13 per cent. This inductive effect seriously affects the regulation, and is frequently the cause of fluctuations in the lights of which your customers complain. It is also undesirable to use very heavy solid wires for alternating current work, as the impedance increases very rapidly with the size of wire. Authorities say that nothing larger than No. 4 B. & S. solid wire should be used. If you have occasion to use larger circuits, use several No. 4 wires or use stranded wire, which can be had for about the same price paid for solid wire.

The question of line wire insulation is something that should be governed by local conditions. Throughout cities and thickly populated towns, where there is danger of telephone, telegraph wires, etc., falling across the primary wires, it is policy to use a good grade of rubber covered wire, but along roads, or through sparsely settled districts, weatherproof wire will serve the purpose. For secondary wiring on poles weatherproof will answer very well.

The next thing to consider is the transformer problem, and I want to say here, if there is one thing more than another in the make-up of an alternating plant that requires special study in its selection and placing, it is the transformer. This feature alone is responsible for the absence of dividends, where a 24 hour service is given, more than any other one thing, and a careful study of the subject will do much toward making the stockholder happy. It is common practice to place a transformer for every customer with a capacity sufficient to take care of his maximum load. The result is that your transformer capacity is up to the number of connected lights. In the business part of a town, and quite frequently in the suburbs, it is possible to establish secondary systems of distribution with very gratifying results. By installing a large transformer, on a pole at some convenient street corner, it is possible, with the use of the 3 wire, secondary system, to distribute a distance of a quarter of a mile in any direction with a very small line loss and at a moderate cost for copper. In this way a square mile of territory can be covered from one center of distribution. By connecting a number of customers to one or more large transformers it is not necessary to have the transformer capacity equal to the connected lights, as it never happens that everybody wants his maximum lights at the same time. I have found it good practice in large secondary systems to allow a converter capacity equal to 40 per cent. of the connected lights, and in some cases I have cut it down to 30 per cent. This method not only reduces the first cost of transformers, by reducing the necessary capacity, but the price per light on large transformers is much less than for small sizes. While the advantage of less first cost is desirable, it by no means represents the chief benefit to be derived from this system of distribution. Where a 24-hour system is given, and even where the circuits are run through the night only, the transformer losses represent the greater part of the kilowatts generated. It is evident, then, that anything done to decrease these perpetual losses will be a clear gain. Aside from the economical advantage of the system, a much better service can be given, the regulation being greatly improved, thus enabling more efficient lamps to be used. With good regulation it is possible to use 3.1 watt lamps, while, with the ordinary service given by alternating current systems, the customer is compelled to use inefficient lamps in order to insure a reasonable length of life. Cases have come to the writer's notice where lamps of 4.3 watts per candle power were used. The cases were investigated on complaints of high bills, which seemed quite natural under the circumstances, the lamps being 40 per cent. below normal efficiency; 16-candle power lamps were consuming 70 watts instead of 50 watts.

Coming back again to the subject of transformers, let me say experience has demonstrated that 150-light transformers are a convenient size to use for the purpose described, for the core loss of this sized transformer should not exceed 150 watts. It is common practice to displace about 15 small transformers with one of this size, the core losses of which would aggregate 750 watts. You can easily figure what this would mean in dollars and cents. Take, for example, a plant with 1,000 burning lights, and assume that 750 of these lights are supplied from 150-light transformers, and the remaining 250 lights supplied from 10-light transformers; then, for a 24-hour service, the core losses for a year would be 17,520 kilowatts; if it costs 5 cents to generate the current the core losses per year will be $876. Assuming again that we are supplying 1,000 burning lights, from old-style transformers of 15 lights capacity each, then the core losses per annum would be 37,580 kilowatts. At a cost of 5 cents per kilowatt, this would amount to $1,879, or a difference in favor of the former method of $1,003. Deducting interest on investment for the new transformers still leaves $928. For a 12-hour service these figures would have to be divided by 2.

I have taken the liberty of dwelling upon the subject of transformers a little longer than would seem proper, but, realizing the importance attached to this point of the installation, I feel that the time will be well spent, if the subject of transformer losses is new to you. Every station should keep a comple record of its transformers, and before a transformer is put into service it should be tested for regulation on no load, one quarter load, one-half load and full load. It should be tested for core loss and copper loss. From these data the different efficiencies of the transformer can be calculated.

To make the keeping of these records as convenient as possible, the writer has designed a set of cards, upon which are printed forms and columns for the different items; one side of the card is used for test data and the other for expense account. By having a record of this kind you can at any time tell just what the efficiency of the transformer is, when it was purchased, what it cost, and what the repair expense has been. Whenever it is necessary to bring a transformer in for repairs, it should always be tested before being put into service again, entering the result of the test and cost of repairs on the card or book. It is hard to realize how useful a system of records is until you have once tried it. It frequently happens that you want to bank two or more transformers, and in doing so it is essential that the secondary voltage of the transformer should be nearly the same, or a burn-out will be the result. A glance at your records will show which transformers should go together.

The method of testing the transformers is quite simple. The only necessary instruments are an alternating current ammeter, a voltmeter and a wattmeter. If a direct reading wattmeter is not at hand a recording wattmeter will serve the purpose. The method of testing for iron loss is shown in Fig. 1. *A* is a 2,000-volt generator with the primary lines leading from it to a transformer, *B*, connected up in the regular way. *C* is a wattmeter connected in the secondary circuit of transformer *B*; *D* is the transformer to be tested. The secondaries of transformer *B* are connected to the secondary of transformer *D*, after passing through the wattmeter *C*. The primary wires of the transformer to be tested are left open. When the current is switched on for the test the wattmeter will register the watts absorbed by the core. The amount of current that would flow through the wires with which the wattmeter is connected, without the core losses is negligible; so all of the energy recorded on the wattmeter might be considered core loss. The method of testing for copper loss is shown in Fig. 2. *A* is the generator, *B* the station transformer, *C* the wattmeter, and *D* the transformer to be tested. In the secondary of *B*, before the wire reaches *C*, there is interposed an adjustable resistance for the purpose of controlling the flow of current. In this case the primaries of *D* are connected to the secondaries of *B*, while the secondaries of *D* are closed through the ammeter. By adjusting the resistance referred to above the current flowing through the secondary of *D* can be regulated to the proper amount, which should be the rated capacity in amperes of the transformer to be tested. In this case the current passing on account of the core losses, etc., is so small that it may be neglected, and the energy registered on the wattmeter may be considered the copper loss. Figure 3 shows the connections for making the regulation test. Here transformer *B* is taken out and *D* put in its place. Now, instruct the attendant at the switchboard to keep the voltage steady while the test is being made. Having provided a bank of lamps, arranged so that they may be switched on as required, then, with a voltmeter connected to the secondaries of *D*, take a reading with no load; next switch on quarter load and take a reading; then half-load with another reading. Now switch the full load and take reading. If you choose, an overload may be put on and readings taken. From the data thus obtained a regulation curve of the transformer can be plotted.

Another advantage of using large transformers with small core losses that should not be lost sight of, is the fact that the capacity of the plant is increased about 5 per cent. This applies to boilers, engines, generators and lines. In other words, if your plant and equipment were of just sufficient capacity to carry 1,000 burning lights in the first case, you would be able, under the new conditions, to carry 1,050 lights, with the same percentage of loss on generator, lines, etc.

There are places in this paper that appear disjointed and unfinished. The truth is: After outlining the necessities of a plant, I had intended to review the subject and discuss the methods of conducting the station, touching upon the cost of generation, the value of coals, the handling of boilers, engines, dynamos, etc. I had also intended to treat the subject of arc lighting to some extent, but realizing that there would be other papers of more importance than this to be read and discussed, I concluded to let the subject rest and trust to the probability of the discussion bringing up points that will be of general interest.

Discussion.

Mr. Britton—I congratulate the Association upon having such a paper read. While some of our members are intensely gas men, in that they are gas men alone, many of us, once also gas men alone, by force of circumstances have become both electric and gas, and to such a paper of this nature is of invaluable service. If when the Society was organized six years ago Mr. Poole could have read that paper, and the members could have taken copies of it home, there is not a man operating an electric lighting plant to-day who would not have saved money; in fact, it is almost impossible to estimate how much he would have saved. He has pointed out errors that have been made in the construction of our plant which would not have been made if we had the guidance of such a man as Mr. Poole. The Association is getting the advice of an electrical engineer for nothing, and it is a service that you cannot appreciate unless you have had to run electric stations by the rule of thumb as we have had to do. We could not employ a capable man to make it up, so it has been made the tail end of the business. But the electric plant is capital, and we are in justice bound to earn money on that capital, and also to do all we can to improve it. It is just as important to have our electric plant complete as it is to have our gas plant complete, for I take it that the electric lighting end of our industry, so far as those of us who control both gas and electric lighting are concerned, is just as important as the gas end of it. I hope the members will study Mr. Poole's paper. I have reason to know from experience the leaks he has pointed out, and they should be stopped in the electric department as they are stopped in the gas department, where leaky mains often trouble us. As gas men not one of us lives who will not spend all the time, money and thought necessary to stop leaks in gas mains, yet there is not a gas man operating an electric plant who pays any attention whatever to line leakages, although leakages in the electric lighting stations are generally equal to output. Not long ago I took occasion one Sunday morning in our electric station (we run a 24-hour service) to read the statement of our station meter and the statement of the consumers' meters as well. We took them again Monday morning, and the result of the comparison was the knowledge that we did not sell over 7½ per cent. of the energy shown by the wattmeters in our station. This was due to inefficient transformers, poor lines of construction, and all that, and I think that this meeting has to the gas men more than repaid itself in the reading of Mr. Poole's paper. I am responsible for it, and that is the reason I am earnest on this proposition. As the Secretary of this Association it is my business to hunt up men who will spend time in the preparation of papers, and Mr. Poole suggested himself to me as a man who could write a paper on matters of that kind if he would. He kindly consented and has given you an able recital. It is a text book on the proper operation of electric lighting stations, and I am satisfied that the delegates here, and others of the Coast gas men not here, when they read that paper will profit by it more than from any other paper they have listened to so far.

The President—When Mr. Britton and Mr. Poole speak about leakage they open up a very sore subject to the gas man. You will all appreciate it when I tell you that at one place in this city four services of our Company were eaten up by the voracious electric current—that there were similar cases belonging to the San Francisco Company, I have no doubt; but although all the talent in town was brought in to discover the offender, none of them would or could tell from whence the devouring current came.

Mr. Aldrich—I hoped the gentleman who read that very interesting paper was about to put some weapon in our hands whereby we could have attacked our friend, the enemy. It appears to me he has simply formulated a plan whereby the gas industry can be wiped off the face of the earth. To that end I suppose we must "conclude" that not many conclusions can be arrived at, for we find ourselves not competent to criticize the paper. On the question of leakage, perhaps, I can give you some information. Although we are a small Company, we have instituted a suit against the Washington Water Power Company, which has a capital of $3,500,000, for damages on account of electrolysis. We engaged the finest electrical expert for testimony who can be obtained in the United States (Prof. Darrow, of Pullman) to go with me over the Power Company's system, to test the amount of leakage from its rails. The leakage was all the way from 22 to 38 volts. Admitting my total lack of knowledge of things electric, of amperes and voltage, I asked the Professor what was the average leakage from the rails, and he replied, "Oh, about 3 or 4 volts." But he said the state of affairs in Spokane was something extraordinary in that the Gas Company's mains should be subjected to this leakage from the Power Company's system. It was all owing to the imperfect bonding of its rails, which verdict has demonstrated to me conclusively that there is only one way in which the pipes of gas and water companies may be protected, notwithstanding any assertion to the contrary by electricians, and that way is by the double return trolley system.

Report of Committee on Nomination of Directors.

Mr. Jones—The committee appointed to report on nominations for Directors for the ensuing year present the following names: Messrs. G. H. Taylor, Chico, Cal.; W. B. Cline, Los Angeles, Cal.; J. B. Grimwood, San Francisco, Cal.; A. L. Rice, Riverside, Cal.

On motion of Mr. Britton the report of the committee was received and the Secretary was instructed to cast the ballot of the Association for the candidates named. When the result of the election was declared, the convention was adjourned, to reassemble at 10:15 A.M., the following day.

[To be Continued.]

Slag Bricks in Germany.

Mr. F. W. Luerman, in *Stahl und Eisen*, gives the following readable account of his experience in the manufacture of bricks from granulated blast furnace slag:

The direct production of building and paving stone from fluid slag, he says, is nothing new. Such slag bricks, however, did not prove a suitable material for dwelling houses, because they are, like glass, impermeable for air as well as steam. In human habitations, the aqueous vapor exhaled by the occupants would condense on cold days on both windows and walls, thus rendering the rooms damp and unhealthy. On the other hand, brick manufactured from granulated blast furnace slag is permeable and hygroscopical—that is, both air and steam can penetrate them.

The first one to produce granulated slag or slag gravel for brick making, by passing the fluid slag through water, was Eugene Langen, an employee of the Friedrichs Wilhelm mine, near Siegberg, Westphalia. This process causes disintegration; silica is separated in a soluble condition, in which it easily hardens in the air and combines just as easily with caustic lime. The single grains of the slag gravel, when compressed tightly, are bound by the soluble silica; and when ground to a fine dust, so that the particles come into closer contact with each other, the binding by the silica therein is sufficient for the production of good building bricks. Bricks from ground slag, however, require a longer time for hardening than those manufactured from granulated slag. By mixing granulated slag with dust from slag which has crumbled in the air, good bricks can be produced without any addition of lime; but the hardening process is rather slow. Hardening takes place quickest in from six to eight days with bricks to which about 10 per cent. of burned and slaked lime has been added.

Granulated slag, from its passage through water, contains from 19 to 33 per cent. of water, according to its porosity—a fact which has to be considered in shipping. Its weight ranges between 1,100 and 1,500 pounds per cubic meter (35.3 cubic feet); that of ground slag runs as high as 2,900 pounds. Ground slag can be added to the mixture of granulated slag and lime when dense and strong bricks are to be produced.

The bricks may be given any shape desired; and they will preserve this shape, because they are not burned. They show sharp edges and smooth surfaces, and give the best satisfaction when as little mortar as possible is used. The natural color of slag bricks is that of grayish white sandstone. The weight ranges, according to dryness and slag used, between 6½ and 7 pounds, or about 6,000 bricks to a 20-ton car.

The strength of slag bricks fully equals that of ordinary burned bricks; 24 to 28 pounds per square centimeter (1.55 square inches) is usually considered the highest admissible burden for ordinary bricks. Well hardened slag bricks can withstand, theoretically, burdens up to 160 and 180 pounds. The resistance of slag bricks to high temperature is quite remarkable. Heated to a pale red, when the carbonate of lime begins to decompose, its strength will not be injured. Even if a part of the lime should be decomposed at such a high temperature, and thus rendered caustic, carbonic acid is again absorbed at a lower temperature, and the brick again becomes as strong as it was before. For the construction of chimneys and stacks, slag bricks are used with advantage, as the products ascending contain a large quantity of free carbonic acid, which is delivered to the bricks. For the same reasons, they are well adapted for lining lime kilns and walling in boilers.

Slag bricks are five times as permeable as ordinary burned bricks. Pressure being equal, 10¼ square feet of lightly burned bricks permit in one minute the passage of 23.3 liters of air; slag bricks permit the pas-

sage of from 101.2 to 113.4 liters. Their porosity also is greater than that of burned bricks; while they do not absorb water as quickly as burned bricks, they regain their permeability quicker than the latter. A burned brick filled up its pores with water in 12 hours, while a slag brick required 190 hours to get thoroughly soaked.

To test whether slag bricks have dried and hardened sufficiently to be safely used, a small piece of brick tied to a string is dipped into a cold concentrated solution of sulphate of soda, and hung up at any place in a room. By the evaporation of the water in the solution and the crystallization of the soda, which in its action resembles the formation of ice, bricks that will not resist frost are destroyed, each crystal needle carrying a little cap of the material from which the brick was produced. Not slag bricks alone, but any other, can be tested in the above mentioned manner as to their power of resistance to frost.

It is said that slag originating from puddling and Thomas pig iron produces the best bricks, while Bessemer and foundry slag ranks second. The erection of a slag brick plant in connection with a blast furnace would cost about $5,000. At several German works the cost of production of 1,000 bricks is only 10 marks ($2.38). From 6,000 to 7,000 pounds of granulated slag and 450 to 700 pounds of burned lime are required for the production of 1,000 bricks.

[From English *Engineering*.]

Coal in the East.

It is almost a commonplace to say that the production of coal and iron in any country determines the position of that country among the countries of the world. Probably in the future, as we become more acquainted with the forces of nature, this may not be true to the same extent as it has been in the past; but we may rest assured that for many a day a cheap supply of coal and iron will be the most important factor in determining the extent and importance of the industrial operations in any part of the globe. If any proof were wanted in support of this opinion, it would be supplied by the report of the Board of Trade to which we recently referred. (See *Engineering*, June 24, 1898, vol. lxv., page 798.) The figures therein given show us, as we indicated, that other nations, and notably the United States of America, are pressing us very hard in supplying coal to those nations which require it, and may, indeed, be able to import it into Britain at a price which would enable it to compete with British coal. The average value of coal at the pit's mouth in the United States for the year 1896 was only 4s. 9½d., whereas in the United Kingdom it was 5s. 10½d. The latter, of course, has the advantage in shipping facilities; but these figures are sufficient to show us that in the future we must expect severe competition in our coal trade from the United States, and both the workers and the masters should remember what we said, that what is true of the individual is also true of the State; "no one is indispensable, and if from any cause we are unable to meet such demands made upon us, others, probably the United States, would step in and the displacement would be permanent." Probably the majority of those who are interested in the subject, or even have studied it from a statistical point of view, will admit the truth of what has been said about the United States, for the facts are well known and cannot be denied; but comparatively few, as yet, recognize the extent and amount of the competition in the coal trade which is growing up in other parts of the world. We recently showed that the Germans have been able to displace us in many of the European markets which we formerly supplied, but meantime we do not propose to make a general survey of the whole subject, but only to glance at the question of coal supply in the East, and consider how it is likely to affect industry and trade, and our relations to them.

Of all the countries in the East, Japan is the one which has attracted most attention on account of its industrial development and the prob ability of competition with British manufactures. But it does not seem likely ever to become a very important factor in coal production, because so far as is known, the coal deposits are not very extensive, and a great part of what is produced will be used up in the industries of the country. In 1883 the total coal production in Japan was a little over 1,000,000 tons, while in 1895 it was nearly 5,000,000 tons. The average market value at the first of these dates was 8s. 8d., while at the latter it had decreased to 5s. Within the past year or so the price has considerably increased on account of the demand for home and foreign use. In 1883 the amount of coal exported from Japan was 390,000 tons, whereas in 1896 it had increased to 2,194,000 tons, chiefly, we understand, to China, Korea, Hong Kong, Burmah, Phillipine Islands, and California. The amount of British coal imported into Japan in 1883 was 9,000 tons, whereas in 1896 it had risen to 49,000 tons, confined almost entirely to Welsh steam coal. Directly, therefore, the increase in the production of coal in Japan has not affected the British coal trade with that country, but indirectly the amount exported has, in many parts of the Far East, practically extinguished it. Moreover, when the coal deposits of Formosa, which are said to be considerable, have been developed, the competition from the Japanese will be greatly increased. Last year about 10,000 tons of coal were produced in Formosa, but that is only a fraction of the possible output, and we may rest assured that the Japanese do not intend any of the natural resources of Formosa to lie idle.

The coal production of China has hitherto been so insignificant that it is treated as a quantity which may be neglected in the report of the Board of Trade. The coal resources of China, however, appear to be immense, and if the one which we recently mentioned be a fair specimen, it is evident that China is destined to become a great industrial country. That one coal field alone is said to be sufficient to supply the world, at the present rate of consumption, for over 2,000 years. It is certain that the syndicate which has obtained such a valuable concession will waste little time in making the most of it. Indeed, it is already reported that the same syndicate has obtained another concession in the province of Ho Nan to work the coal and iron mines in that region for a period of 60 years. The concession includes the right to construct the necessary connecting railways with the works to be undertaken by the same syndicate in the province of Shan-Si. It is stated on good authority that coal is found in every province in China; and when railways are constructed the abundant cheap labor of the country will be attracted to the new industry, which, with all its attendant results, is certain to bring about many changes in the commerce and social conditions of China.

The Russians have now got hold of the resources of Manchuria, and when the Trans-Siberian railway and its connecting lines have been completed, there will be an immense industrial development in that part of the world. Some time ago an Imperial Russian Commission investigated the coal deposits along the line of the Trans-Siberian Railway, and they reported that they had discovered upwards of 50 groups of workable coal seams, and their results have been confirmed by an American Commission sent out to investigate the subject; for the Americans are not by any means content with the vast resources of their own country, but seem to have their eyes on all quarters of the globe. With the development of the resources of Manchuria and of the Yangtze Valley, it is impossible to form any idea of the industrial and commercial changes which are likely to take place.

British India is rapidly increasing her production of coal. In 1883 it was 1,315,976 tons, while in 1896 it had reached 3,848,013 tons. The quantity of coal imported into India in 1883 was 712,900 tons, whereas in 1896 it had decreased to 494,960 tons. On the other hand, 136,719 tons were exported from India in 1896, so that it is very safe to say that in a comparatively short time India will practically have ceased to buy coal from us. Indian coal is said to be specially adapted for steam raising, and some of it is said to be as good as Welsh coal for this purpose. There is also a possibility of French Indo-China coming into direct competition with the coal of India in some of the Eastern markets; but the resources of that country are small compared with China proper, and capitalists are certain to put their money into coal fields which offer the best prospects.

The supplies of coal from Japan, British India, and China, must cause the trade in coal between Australasia and the Far East to diminish and ultimately to disappear, and already the competition is becoming very keen, so that the coal trade in the British colonies is exposed to the same difficulties as those which beset the mother country.

In a recent article, giving a summary of the report of the Board of Trade, our contemporary, the *Statist*, gave the following table showing the present annual coal producing capacity of the Pacific and the Far East:

	Tons.
British India	4,500,000
Japan	5,000,000
Australasia	6,000,000
China, Formosa, Indo-China, Dutch East Indies, Borneo and Eastern Siberia	4,250,000
British Columbia	1,000,000
Chili	500,000
Natal and Transvaal (whose outputs are available for the Indian Ocean)	1,750,000
Total	23,000,000
To this add the exports from the United Kingdom to east of Cape of Good Hope and west of Cape Horn	1,700,000
Grand total of consumption	24,700,000

(Or, say, 25,000,000 tons.)

Of this amount about 50 per cent. comes from British possessions, but when the sources of supply which we have mentioned are developed, it is very probable that the proportions may be very much changed, and, moreover, that not only will the demand for British coal be diminished in the countries of the Far East, but also that the competition in the other markets of the world will be intensified. This possibility should be carefully remembered by all concerned.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

A CORRESPONDENT at Binghamton, N. Y., writing under date of the 12th inst., says: "The new offices of the Binghamton gas works have been occupied since July 15th. The offices have been visited by over 3,000 people, and all have expressed themselves as much pleased with the beauty of the office appointments and the arrangements for the convenience of the public. Much success attended the series of demonstration lectures on cooking by gas, which lectures were delivered by Mrs. Eva Squire, of New York. The lectures were given in the Company's new office headquarters, and the audiences were not only large, but were made up of the very best people in Binghamton. As a result the Company is now on its second carload of Jewel ranges. A mile of main a week is being laid just now, mostly of 6 and 8-inch pipe. The offices of the Company have attached thereto a spacious workshop, 30 feet by 80 feet, fitted with all conveniences for the dispatch of rush business. The walls of the office are hung with choice pictures, and casts and bric-a-brac adorn the room. An elegant oxidized brass mantel, with large back mirror, brass fender and andirons, and Backus heater, ornaments one side of the front office. The Manager's office and Directors' room are likewise decorated with fine pictures and casts, and a beautiful statue by Mercier, representing David slaying Goliath. Superb Persian rugs adorn front and private offices."

THE Western Gas Construction Company has been awarded a contract for the furnishing of 216 mouthpieces to the Buffalo (N. Y.) Company.

IT is reported that negotiations are underway looking to the purchase of the Quincy (Ills) Gas Light and Coke Company and the local electric light works. If the negotiations are successful the plants will be operated on joint account.

A RECENT issue of the Boston *Transcript* says that a lively contest is expected in Somerville (Mass.) between the City Council and the Somerville Electric Light Company, which furnishes light for the city. The last contract expired nearly a year ago, and the City Council has thus far failed to renew it. At the last meeting of the Council the Mayor suggested it was high time the contract was made. The Committee on Street Lights has just completed a tour of investigation throughout the city, and the result of the inspection has been far from satisfactory. The Committee found many streets not lighted at all, owing to the improper location of the lamps. The Committee will, consequently, ask the City Council for authority to make a new contract on the condition that the Electric Light Company relocate, at its own expense, a large number of arc lamps. On this is likely to be a serious hitch, for friends of the Company say that it will never submit to relocating the lamps, at its expense, since the lamps were originally placed at the dictation of the Council.

MR. ROBERT A. STRANAHAN, formerly well known in the South as a constructor of gas works, died at his home, Boston, Mass., the evening of August 9th.

THERE is no longer any doubt that a gas plant will be constructed at Waukegan, Ills. The plans include the construction of a 60,000 feet holder, and the placing this fall of at least 4 miles of mains.

MR. C. N. PAYNE, President of the Pennsylvania Gas Company, has notified the residents of Erie, Pa., that the following rates shall rule for a supply of natural gas: "29 cents for each 1,000 cubic feet, subject, however, to a discount of 2 cents for each 1,000 cubic feet on all bills paid on or before the 10th day of the month in which gas is delivered."

A CORRESPONDENT in Chicago forwards the following: "The Aurora (Ills.) Gas Light Company, moved into its new office quarters early this month. The offices are in the Linden building, and the officials of the Company, and its patrons as well, cannot fail to be pleased with the new arrangement. Manager Copley's quarters are exceptionally cozy and useful. In fact, when the finishing touches are reached, the Company will have as handsome a set of offices as can be found in Aurora."

THE proprietors of the Santa Rosa (Cal.) Gas and Electric Light Company are putting down additional mains. A noteworthy fact in connection therewith is that much of the extending is traceable to the desire of the residents along the new lines to use gas for cooking purposes.

A GAS works is to be constructed at Mason City, Iowa. Strange to say, a woman (Mrs. M. I. Clark) is the head of the enterprise.

AT a recent meeting of the Frankfort (Ky.) Council a resolution was adopted authorizing the employment of attorneys to defend the city, or bring suit against the Gas Company, involving the validity of the contract selling the gas works to the present corporation. The sale was made in June, 1882, and since that time two suits have been brought and determined on that contract. The first suit was dismissed in the Circuit Court, and the second was decided against the city in both the Circuit Court and Court of Appeals. In the last case the main question at issue was the payment of an account for gas against the city under the contract. The city pleaded an offset for city taxes on the ground that the city could not exempt anyone from taxation, as this was in violation of law and against public policy. The Appellate Court decided "The contract made to be reasonable; that there was no injustice or oppression on the citizen or the public by reason of any of its provisions. It was not an agreement against public policy or public morals, and if the exemption was eliminated from the contract the Chancellor would compel the city to add the amount to the cost of lighting the streets. The right of the city to sell was conceded, and the Council were the sole judges of the condition to be paid."

MRS. SMITH, wife of the proprietor of the Smith Hotel, Deepwater, Mo. (Deepwater is an outlying district of Clinton), was seriously burned some days ago through an explosion of acetylene gas. The hotel was lighted by an acetylene gas machine. The latter was out of order, and Mrs. Smith endeavored to locate the trouble with a view to remedying it. When Mrs. Smith opened the generator a great volume of gas rushed out. Mrs. Smith carried a lighted lamp. The gas, coming in contact with the lamp flame, exploded, and Mrs. Smith was badly burned on face and arms. No fire followed the explosion.

A VERY handsome feature of the 4th of July celebration at Seattle, Wash., this year was the street illumination furnished by Manager Collins, of the Seattle Gas and Electric Company. The set piece of the display (an eagle perched between two American flags and surmounted by 5-pointed stars) was done in gas jets, and the balance of the lighting, as to the arches, etc., was done with incandescent electric lamps.

THE Chicago *Tribune*, of the 13th inst., says that, by transfers recorded the day before, the Commonwealth Electric Company secures property of the Calumet Gas Company as a step in the Edison Company's absorption of other electric light companies in the city. The plants are in Garfield boulevard, 115.8 feet west of Wallace street, north front, 50 by 130 feet, and in 56th street, 16 feet west of Wallace street, south front, 141.8 by 350.52 feet. The consideration of the transfer is $500,000. The instrument is signed on behalf of the Calumet Gas Company, by Martin J. Russell, Vice-President, and Lyman A. Walton, Secretary. The transfer includes all buildings and works, also the machinery. It is also intended to sell all property of the Calumet gas Company pertaining to the electric light business, with all electric machinery, etc., located at 96th street and Erie avenue, South Chicago, but reserving all real estate belonging to the Company and all property, real, personal and mixed, pertaining to its business of manufacturing, supplying and selling gas. The documents required $500 in revenue stamps.

THE new owners of the Williamsport (Pa.) Gas Company have announced a reduced rate for gas used for cooking, heating and power purposes. Under the new schedule the gas will be billed at $1.50 per 1,000 cubic feet, and prompt payment (within 10 days) will entitle the user to a rebate of 25 cents per 1,000 cubic feet. The proprietors have under consideration a new schedule for gas used for illumination, and while the exact scale has not been agreed upon, we feel safe in asserting that the horizontal cut over the old gross price will not be less than $1 per 1,000. Meanwhile, Superintendent Lane is a very busy man, arranging for main extensions and plant enlargement.

SUPERINTENDENT MOSES, of the Peoples Gas Improvement Company, Trenton, N. J., says that the plant will be in operation before November.

THE Directors of the Chelsea (Mass.) Gas Light Company have perfected the following execuitve management: President, Jabez K. Montgomery; Vice-President and General Counsel, Albert D. Bosson; Treasurer and General Manager, George W. Moses.

THE new owners of the Citizens Gas and Electric Company, of White Plains, N. Y., have mortgaged the plant for $350,000 to the State Trust Company as security for bonds issued or to be issued to that amount.

THE Detroit City Gas Company has issued the following amended rate schedule for a supply of natural gas: For the first 25,000 cubic feet, or any part thereof, 28 cents per 1,000; for the next 75,000 cubic feet, or any part thereof, 25 cents per 1,000; for the next 100,000 cubic feet, or any part thereof, 22 cents per 1,000; for the next 200,000 feet, or any part thereof, 20 cents per 1,000; all gas used in excess of 400,000 cubic feet, 18 cents per 1,000.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 32 Pine Street, New York.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.
PACIFIC COAST GAS ASSOCIATION.
TEXAS GAS AND ELECTRIC LIGHT ASSOCIATION.

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 Cents.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, AUG. 22, 1898.

Crystallized Calcium Metal.

Nature says that since the memorable researches of Humphry Davy on the decomposition of the alkaline earths, many methods have been suggested for preparing the metal calcium in the pure state. M. Moissan, in the current number of the *Comptes Rendus*, after showing that none of these yields a pure metal, describes two ways of preparing crystallized calcium containing less than 1 per cent. of impurities.

The first of the methods depends upon the property possessed by calcium of dissolving in liquid sodium at a dull red heat, and separating out in crystals on cooling. By treating the mass cautiously with absolute alcohol the sodium is removed, and the calcium is obtained in the form of brilliant white hexagonal crystals. Similar white crystals of calcium can be obtained by the electrolysis of fused calcium iodide. It is noteworthy that calcium has usually been described by previous workers as a yellow metal; doubtless owing to the presence of impurities.

The Market for Gas Securities.

The feature of the city gas share market this week was a break in Consolidated, which, opening on Thursday at 198, sold down to 193. The dealings in it were on a comparatively large scale, the transactions for the day amounting to 2,125 shares. To-day (Friday) the opening was 194 to 194½, and at noon trades had been made at 195. So far as we know, there was no real reason for the slump. Traders in the stock should not overlook the fact that the quarterly dividend is payable September 15. Other city shares, notably Standards, are higher.

Brooklyn Union is 128 bid. Peoples, of Chicago, having sold up to 106, had a sharp fall, the opening to-day having been made at 101⅝ to 101¼. The hugger-muggering on Benedict account is responsible for the drop. It is quite likely to go lower, simply through manipulation. Consolidated, of Baltimore, is advancing steadily, the bid for it this week being 66¼. Laclede common is 52¾ bid. It is carrying a dividend of 1¼ per cent. Wilmington, Del., is 204 bid. That Company is enjoying a wonderfully prosperous trade, due to the sensible management of its owners.

Gas Stocks.

Quotations by Frederic R. Cochran & Co., Brokers and Dealers in Gas Stocks.

20 AND 22 BROAD STREET, NEW YORK CITY.

AUG. 22.

☞ All communications will receive particular attention ☜ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$36,230,000	100	194	194⅛
Cental Union, Bonds, 5's	3,000,000	1,000	104	105
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	330	340
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
New Amsterdam Gas Co.	13,000,000	100	30	30¼
Preferred	10,000,000	100	72¾	73⅛
Bonds, 5's	11,000,000	1,000	102⅝	103
Northern Union, Bonds, 5's	1,250,000	1,000	94½	95½
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	111	113
" 1st Con. 5's	1,500,000	..	106	109
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	144	150
Preferred	5,000,000	100	160	166
Bonds, 1st Mortgage, 5's	1,500,000	1,000	112	114
Yonkers	299,65	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	128	128¾
" " Bonds (5's)	15 000,000	1,000	115	115⅛
Bay State	50,000,000	50	3¼	3⅜
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	..
" 1st Mtg. 5's	450,000	1,000	..	..
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	92	..
2d " " "	3,000,000	1,000	..	80
Buffalo City Gas Co.	5,500,000	100	23	24
" " Bonds, 5's	5,250,000	1,000	95½	96½
Central, San Francisco	2,000,000	..	105	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus	1,144,700	100	89	91
1st Mortgage	1,207,000	1,000	101	103½
Consumers. Jersey City	2,000,000	100	78	85
" Bonds	600,000	1,000	101½	103½
Cincinnati G. & C. Co.	8,500,000	100	203¾	203¾
Consumers, Toronto	1,600,000	50	184½	187
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Consolidated, Baltimore	11,000,000	100	66¼	66¾
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,400 000	..	..	..
Consolidated Gas Co. of N.J.	1,000,000	100	16	21
" Con. Mtg. 5's	380,000	1,000	75	80
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,500,000	50	58	60
" Prior Lien 5's	4,538,000	1,000	94	..
Detroit Gas Co., 5's	428,000	1,000	..	..
" Inc. 5's	34,000	100	..	..
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	75	80
" Bonds	2,000,000	..	88	91
Grand Rapids Gas Lt. Co.	1,000,000	50	..	..
" 1st Mtg. 5's	1,125,000	1,000	..	..
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	115	125
" Bonds, 6's	2 650,000	..	106	107
Jackson Gas Co.	250,000	50	..	..
" 1st Mtg. 5's	250,000	1,000	..	..
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	78	83
Bonds	1,000,000	1,000	90	91
Louisville	2,370,000	50	..	..
Laclede, St. Louis	7,500,000	100	52¾	53
Preferred	2,500,000	100	94	96
Bonds	10,000,000	1,000	105	105¼
Madison Gas & Elec. Co.	400,000	100	..	..
" 1st Mtg. 6's	350,000	1,000	..	..
Montreal, Canada	2,000,000	100	200	..
Newark, N. J., Gas Co.	1,000,000	..	200	220
Bonds, 6's	4,000,000	..	128	130x
New Haven	1,000,000	25	252	..
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	52	53
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	101⅜	101½
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	.	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	83	..
Consolidated 5's	2,000,000		87½	90
San Francisco, Cal.	10,000,000	100	85⅜	86
St. Paul Gas Light Co.	1,500,000	100	49	51
1st Mortgage 6's	650,000	1,000	84	87
Extension, 5's	600,000	1,000	..	..
General Mortgage, 5's	2,425,000	1,000	80	82
St. Joseph Gas Co.	1,000,000	100	..	..
" 1st Mtg. 5's	750,000	1,000	..	..
Syracuse, N. Y.	1,750,000	100	17	18
Bonds	1,500,000	1,000	94	97
Washington, D. C	2,000,000	20	250	
Western, Milwaukee	4,000,000	100	85¼	86
Bonds, 5's	3,556,000	.	101¾	102½
Wilmington, Del.	550,000		204	206

Advertisers' Index.

GAS ENGINEERS.

	Page
Wm. Henry White, New York City	291
Fred. Bredel, Milwaukee, Wis.	278
Geo. R. Rowland, New York City	291
The Western Gas Construction Co., Fort Wayne, Ind.	280
Humphreys & Glasgow, New York City	284
American Gas Co., Phila., Pa.	278
David Leavitt Hough, New York City	293
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	291
Baxter & Lynn, Detroit, Mich.	274

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md.	289
United Gas Improvement Co., Phila., Pa.	285
Burdett Loomis, Hartford, Conn.	290
National Gas and Water Co., Chicago, Ills.	285
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	291
The Western Gas Construction Co., Fort Wayne, Ind.	280
Humphreys & Glasgow, New York City	284

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd's Sons, New York City	292
Continental Iron Works, Brooklyn, N. Y.	290
Deily & Fowler, Phila., Pa.	292
Kerr Murray Mfg. Co., Fort Wayne, Ind	288
Stacey Mfg. Co., Cincinnati, Ohio.	291
Bartlett, Hayward & Co., Baltimore, Md.	289
Davis and Farnum Mfg. Co., Waltham, Mass.	288
R. D. Wood & Co., Phila., Pa.	290
Isbell-Porter Company, New York City	290
Fred. Bredel, Milwaukee, Wis.	278
United Gas Improvement Co., Phila., Pa.	285
Berlin Iron Bridge Co., East Berlin, Conn.	277
National Gas and Water Co., Chicago, Ills.	285
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	291
The Western Gas Construction Co., Fort Wayne, Ind.	280
Humphreys & Glasgow, New York City	284
Gas Engineering Co., Pittsburgh, Pa.	288
American Gas Co., Phila., Pa.	278
Logan Iron Works, Brooklyn, N. Y.	292
Riter-Conley Co., Pittsburgh, Pa.	284
Baxter & Lynn, Detroit, Mich.	274

SCRUBBERS AND CONDENSERS.

G. Shepard Page's Sons, New York City	291
R. D. Wood & Co., Phila., Pa.	290
James R. Floyd's Sons, New York City	292
Continental Iron Works, Brooklyn, N. Y.	290
Gas Engineering Co., Pittsburgh, Pa.	288
Logan Iron Works, Brooklyn, N. Y.	292
Riter-Conley Co., Pittsburgh, Pa.	284

TAR AND CARBONIC ACID EXTRACTOR.

G. Shepard Page's Sons, New York City	291
R. D. Wood & Co., Phila., Pa.	290

AMMONIA CONCENTRATORS.

Michigan Ammonia Works, Detroit, Mich.	275
G. Shepard Page's Sons, New York City	291
Gas Engineering Co., Pittsburgh, Pa.	288

GAS METERS.

John J. Griffin & Co., Phila., Pa. 296
American Meter Co., New York and Philadelphia 295
Helme & McIlhenny, Phila., Pa. 295
D. McDonald & Co., Albany, N.Y. 293
Nathaniel Tufts Meter Co., Boston, Mass. 294
Maryland Meter and Mfg. Co., Baltimore, Md. 294
Metric Metal Co., Erie, Pa 294
Keystone Meter Co., Royersford, Pa. 294
Detroit Meter Company, Detroit, Mich. 295

PREPAYMENT METERS.

American Meter Co.. New York and Philadelphia 295
John J. Griffin & Co., Phila., Pa. 296
D. McDonald & Co., Albany, N. Y. 293
Helme & McIlhenny, Phila., Pa. 295

GAS AND WATER PIPES.

Ohio Pipe Co., Columbus, Ohio 293
M. J. Drummond & Co., New York City 293
R. D. Wood & Co., Phila., Pa. 290
Warren Foundry and Machine Co., New York City 293
Donaldson Iron Co., Emaus, Pa. 293
Utica Pipe Foundry Co., Utica, N. Y. 293

PIPE CUTTERS.

The Anderson Pipe Cutter Co., East Boston, Mass. 277

PIPE JOINTS.

Bayles Engineering Co., New York City 275

STEAM BLOWER FOR BURNING BREEZE.

H. E. Parson, Brooklyn, N. Y. 285

GAS COALS.

Penn Gas Coal Co., Phila., Pa. 287
Perkins & Co., New York City 286
Despard Gas Coal Co., Baltimore, Md. 287
Westmoreland Coal Co., Phila., Pa. 287
Berwind-White Coal Mining Co., New York and Phila. .. 286
W. D. Althouse & Co., Phila., Pa. 287

CANNEL COALS.

Perkins & Co., New York City 286
W. D. Althouse & Co., Phila., Pa. 287
Greasy Creek Cannel Coal & Tramway Co., Chicago, Ills. 275

GAS ENRICHERS.

Standard Oil Co., New York City 287
The Sun Oil Co., Pittsburgh, Pa. 287

COKE CRUSHER.

C. M. Keller, Columbus, Ind. 287

GAS GAUGES.

The Bristol Co., Waterbury, Conn. 275

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City 285
Isbell-Porter Co., New York City 290
R. D. Wood & Co., Phila., Pa. 290
Wm. M. Crane & Co., New York City 58

CEMENTS.

C. L. Gerould & Co., Mount Vernon, N.Y. 276

RETORTS AND FIREBRICKS.

J. H. Gautier & Co., Jersey City, N. J. 276
B. Kreischer & Sons, New York City 276
Adam Weber, New York City 276
Laclede Firebrick Mfg. Co., St. Louis, Mo. 276
Cyrus Borgner, Phila., Pa. 276
James Gardner, Jr., Pittsburgh, Pa. 276
Henry Maurer & Son, New York City 276
Baltimore Retort and Firebrick Co., Baltimore, Md. 276
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. 276
Brooklyn Firebrick Works, Brooklyn, N. Y. 276
F. Behrend, New York City 277

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md. 289
Fred. Bredel, Milwaukee, Wis. 278
J. H. Gautier & Co., Jersey City, N. J. 276
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. 276
Adam Weber New York City 276

SELF-SEALING MOUTHPIECE DOORS.

Isbell-Porter Co., New York City 290
Continental Iron Works, Brooklyn, N.Y. 290
G. Shepard Page's Sons, New York City 291
Logan Iron Works, Brooklyn, N. Y. 292
R. D. Wood & Co., Phila., Pa. 290

INCANDESCENT GAS LAMPS.

Welsbach Commercial Co., Phila., Pa. 282
Victor Incandescent Company, New York City 275
Hugo Cahen, Berlin, Germany 275

MICA GOODS.

The Mica Mfg. Co., New York City 275

BURNERS.

C. A. Gefrorer, Phila., Pa. 290
Wm. M. Crane & Co., New York City 58

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn. 274

STREET LAMPS.

Welsbach Street Lighting Co., New York and Phila. 284

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City 285
Greenpoint Chemical Works, Brooklyn, N.Y. 285
Gas Purification and Chemical Co., Ltd., London 285

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind. 279
Isbell-Porter Company, New York City 290
Connelly Iron Sponge and Governor Co., New York City 285

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y. 280
Chapman Valve Manufacturing Co., Boston, Mass. 280
R. D. Wood & Co., Phila., Pa. 290
Continental Iron Works, Brooklyn, N. Y. 290
The P. H. & F. M. Roots Co., Connersville, Ind. 279
Isbell-Porter Co., New York City 290
The Western Gas Construction Co., Fort Wayne Ind. ... 280

ELECTRICAL APPARATUS.

Wm. Henry White, New York City 291

GAS ENGINES.

Otto Gas Engine Works, Phila., Pa. 260
Backus Water Motor Co., Newark, N. J. 238

ENGINES AND BOILERS.

The Hazelton Boiler Company, New York City 277
W. G. & G. Greenfield, East Newark, N. J. 298

PURIFIER SCREENS.

John Cabot, New York City 275

GAS STOVES.

American Meter Co., New York and Philadelphia 281
Maryland Meter and Manufacturing Co., Baltimore, Md. 294
Keystone Meter Co., Royersford, Pa. 294
Wm. M. Crane & Co., New York City 58
The Schneider & Trenkamp Co., Cleveland, Ohio 59

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N. Y. 280

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md. 289
Continental Iron Works, Brooklyn, N. Y. 290
Deily & Fowler, Philadelphia, Pa. 292
Davis & Farnum Mfg. Co., Waltham, Mass. 288
Kerr Murray Mfg. Co., Fort Wayne, Ind. 288
Stacey Mfg. Co., Cincinnati, Ohio 291
R. D. Wood & Co., Philadelphia, Pa. 290
Logan Iron Works, Brooklyn, N. Y. 292
Riter Conley Co., Pittsburgh, Pa. 284

BOOKS, ETC.

Scientific Books 286
Digest of Gas Cases 287
Practical Photometry 276
Gas Flow Computers 295
Hughes' "Gas Works" 285
Poole on Fuels 289
Gas Engineer's Pocket-Book 277

DIVIDEND NOTICE.

OFFICE OF WELSBACH COMMERCIAL COMPANY,
40 WALL ST., NEW YORK CITY, Aug. 11, 1898.

The Directors have this day declared a quarterly dividend of two (2) per cent. on the preferred stock, payable Sept. 9, 1898, to stockholders of record at the close of business Aug. 31, 1898. Transfer books of the preferred stock will be closed from Sept. 1 to Sept. 9, 1898, both inclusive. Checks will be mailed

1211-3 EDWARD C. LEE, Treasurer.

Position Wanted.

A young, active engineer wants the management of a gas property, or a position under an older man at a large works.

1184-tf "M. L. B.," care this Journal.

WANTED TO BUY OR LEASE,

Gas Plant in Town of 8,000 to 20 000 Population, East of Mississipi River.

No objection to run-down plant if it can be had on equitable terms.

1211-tf Address "J. B.," care this Journal.

DR. MOSS is open to engage with responsible firm as representative, or charge of works. Will advise on all difficulties met with in the manufacture and distribution of Coal, Oil or Water Gas. Terms reasonable.

Address
DR. MOSS,
1178-tf Care this Journal.

WANTED,

A Good Second-Hand Exhauster and Engine Combined, to Pass 30,000 Cubic Feet per Hour.

Write to THE OTTAWA GAS COMPANY,
1208-tf Ottawa, Canada.

FOR SALE.

Twelve or Sixteen Bredel Mouthpieces, in Good Shape.

Write THE DALLAS GAS AND FUEL CO.,
1208-9 Dallas, Texas.

For Sale.

A Small Gas and Electric Light Plant,

in a Southern city of 3,800 inhabitants.

Address FORT WAYNE ELECTRIC CORPORATION,
1097-tf Fort Wayne, Ind

FOR SALE.

Hydraulic, Dip, Branch and Ascension Pipes, Mouthpieces and Lids, for four Benches of 5's and for one Bench of 3 retorts.

Two Coolers, or Air Condensers, each of 150 000 cubic feet capacity.

Multitubular Condenser, shell, 36 in. diameter, with 98 2-in. tubes, 10 ft. 6 in. long.

D-Shaped Tar Extractor, 8 ft. long, 1 ft. 6 in. deep.

Scrubber, 48 in. diameter, 11 ft. 9 in. high. Three man holes, 11 in. by 15 in.

S-inch Center Seal. Four Purifiers, 8 ft. x 6 ft.

KEY CITY GAS CO
1119-tf Dubuque, Iowa.

Steward's Specials

ARE

DURABLE, UNIFORM,

AND OF

AMERICAN MANUFACTURE.

Samples will be cheerfully sent to Gas Companies.

WE MAKE LAVA TIPS OF ALL KINDS.

THE D. M. STEWARD MFG. CO.,
CHATTANOOGA, TENN.

BAXTER & LYNN.

GAS ENGINEERING
AND
CONSTRUCTION.

Examination Made of Gas Properties.

Values Ascertained, and
Advice as to Management.

OFFICE: WAYNE COUNTY BANK BUILDING,
DETROIT, MICH.

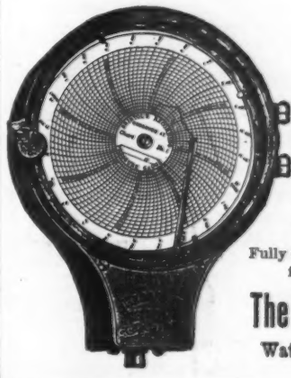
Utilize Your Gas Liquor.
NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator.

Not Expensive. Write to
STROH & OSIUS, Pat'ees, or
Mich. Ammonia Works, Detroit, Mich.

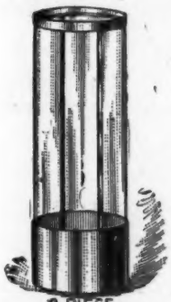
Special Trays for Iron Sponge or Oxide of Iron,
CHURCH'S TRAYS a Specialty.
Reversible, Strongest, Most Durable, Most Easily Repaired.

553-557 West Thirty-third Street, New York.
We also make the Cheapest and Strongest
REVERSIBLE BOLTED TRAYS IN THE MARKET.
Send for Circulars.



BRISTOL'S RECORDING
PRESSURE GAUGE.
For continuous records of
Street Gas Pressure
Simple in Construction, Accurate in Operation
Low in Price.
Fully Guaranteed. Send for Circulars.
The Bristol Co.,
Waterbury, Conn.

Our Mica Chimneys



Etched Chimneys to Order.

For Welsbach Lights
ARE THE
BEST IN THE WORLD.
Get Catalog and Discounts.
The MICA MFG. CO
Micasmiths,
88 Fulton Street, N. Y. City.

KENTUCKY CANNEL COAL, FOR GAS AND DOMESTIC USE.

GEO. R. HISLOP, F.C.S., F.R.S.S.A., Gas Engineer of Paisley, Scotland, says in his analysis: "This is a remarkably rich Cannel Coal, yielding illuminating matter per ton equivalent to 1,945 lbs. of sperm candles."
This coal mined and shipped in box cars. Write for sample car and delivered price.

The Greasy Creek Cannel Coal and Tramway Co.,
58 and 60 WALDO PLACE, CHICAGO, ILL.

"VICTOR" Regenerative Incandescent Gas Lamps and Mantles

No Air Shutter, therefore no Smoked Mantles. Hot Air taken from Chimney. Impossible to snap back. "VICTOR" MANTLES are the strongest and most durable on the Market.
Address for full particulars and Illustrated Catalogue,
VICTOR INCANDESCENT CO., 171-173 6th Ave., N.Y. City.

Gas Distribution Without Leakage Loss.
THE PANTACLINAL SYSTEM.

This system includes: Pantaclinal Mains, which are gas tight when laid and remain gas tight during their life in the ground. Also
PANTACLINAL SPECIAL FITTINGS.

To correct the evils incident to rigidity in lines already laid. To repair breaks in mains so that they will not break again. To permit the use, without future disadvantage from leaks or breaks, of stocks of hub and spigot mains on hand or ordered. To permit the relaying, as Pantaclinal lines, of hub and spigot lines now unduly troublesome and expensive to maintain, owing to heavy leakage and liability to fracture. To flexibly couple wrought iron pipes, and correct the enormous leakage which attends their use in gas distribution when laid with rigid couplings. To correct causes of leakage at service taps.

BAYLES ENGINEERING COMPANY,
ENGINEERING DEPARTMENT,
14 CORTLANDT STREET, - - NEW YORK.

INCANDESCENT GAS LIGHT.
American Patent No. 575,262, of December 1, 1897.

NO INFRINGEMENT OF THE "WELSBACH" PATENT.

Highest Lighting Power, in Combination with Greatest Durability.

Mantles Impregnated, - - - 100 pieces, 22 Marks.
Transportable Mantles, ready for use, 100 pieces, 32 Marks.

Prices, c.i.f. Hamburg or Bremen.

HUGO CAHEN, Manufacturer of Incandescent Gas Fittings,
No. 61 Elsasserstrasse, BERLIN, N., GERMANY.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY Prest. DAVID R. DALY V. Prest. & Treas.
H. D. ABERNETHY. Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

E. D. WHITE, President. A. H. GUTKES, Vice-President. H. A. PERKINS, Secretary.

Brooklyn Fire Brick Works,

MANUFACTURERS OF

CLAY RETORTS, FIRE BRICK,
Gas House and other Tile.

Office, 88 Van Dyke St., Brooklyn, N. Y.

Established 1854. Incorporated 1869.

LACLEDE
Fire Brick Manufg. Co.,

Manufacturers of { GAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Exclusive Agents for

The Mitchell Half-Depth Regenerative Furnace.

This is the *original* coal-consuming Furnace for Retort Benches. Burns either Coal or Coke. Full and Half-Depth Regenerative Furnaces for Benches of 6's, 7's, 8's or 9's erected complete.

Proprietors of the Coze System of Inclined Retorts.

Office: 901 Pine St., **St. Louis, Mo.**

ESTABLISHED IN 1845.

B. KREISCHER & SONS,

Office, 119 E. 23d St., New York.

Gas Retorts,

TILES, FIRE BRICK.

AND EVERYTHING IN THE FIRE CLAY LINE.

Adam Weber,

Proprietor,

Manhattan Fire Brick and Enameled Clay Retort Works.

Works, Weber, N. J.

Office, 633 East 15th St., New York.

Modern Recuperative Furnaces

And Standard Fire Brick and Gas Retorts.

Works,
LOCKPORT STATION, PA.

—ESTABLISHED 1864.—

JAMES GARDNER, JR.,

Hamilton Building, Fifth Avenue,
PITTSBURGH, PA. P. O. Box 373

Successor to WILLIAM GARDNER & SON

Fire Clay Goods for Gas Works.

SOLE REPRESENTATIVE OF THE McILHENNY REGENERATIVE BENCHES FOR THE U. S.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

A cement of great value for patching retorts, putting on mouth-pieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

PRICE LIST.

In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD & CO.,

N. 3d & Prospect Avs., Mt. Vernon, N.Y.

Western Agent, H. T. GEROULD, Centralia, Ills.

Parker-Russell Mining and Mfg. Co.,

CITY OFFICE,
417 Pine Street, St. Louis, Mo.

PROPRIETORS OF THE

OAKHILL GAS RETORT & FIRE BRICK W'KS

Our immense establishment is now employed almost entirely in the manufacture of

Materials for Gas Companies

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We construct

Half and Full Depth Benches of Our Own Design,

Containing 6, 8 or 9 Retorts.

We have Greatly Improved our Recuperators. Coal or Coke can be used as Fuel in Furnaces.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec'y
A. LAMBLA, Vice-Prest. and Supt.

BALTIMORE RETORT & FIRE BRICK CO.

MANUFACTORY AT

LOCUST POINT BALTIMORE MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY,
AND FIRE CEMENT.

Red and Buff Ornamental Tiles and Chimney Tops. Baker Oven Tiles 12x12x2 and 16x16x2.

WALDO BROS., 102 MILK ST., BOSTON, MASS.

Sole Agents for New England States.

PRACTICAL PHOTOMETRY.

A Guide to the Study of the Measurement of Light.

By WILLIAM JOSEPH DIBDIN.

With Numerous Illustrations. Price, $3.00 A. M. CALLENDER & CO., 32 Pine Street, N. Y. City

HIGH-PRESSURE
WATER-TUBE BOILERS.

THE HAZELTON OR PORCUPINE BOILER
IN 50 to 500 H. P. UNITS.

SINGLE BOILERS OR COMPACT BATTERIES.
GREAT SAVING OF FLOOR SPACE
AND FUEL.

LARGE-SIZE BOILERS IN STOCK.

Our new book, "The Generation of Power," will be mailed on request.

THE HAZELTON BOILER CO.
Sole Proprietors and Manufacturers.
ALSO BUILDERS OF
Stacks, Tanks and Miscellaneous Metal Work.
GENERAL OFFICE:
No. 716 E. 13th ST., New York, U.S.A.

Cable Address, "Palia," New York.
Telephone Call, 1229-18th Street, New York.

F. BEHREND,
SOLE IMPORTER OF THE CELEBRATED
German (Stettin-Didier) Clay Gas Retorts,
BLOCKS, TILES, FIREBRICKS, FIRE CEMENT
Stettin "Anchor" & "Eagle" Brand Portland Cement
10 & 12 Old Slip, New York.

Iron Roof For Sale.

Width of building, 155 feet out to out, divided into a center span 66 feet, with a wing on each side 43 feet 6 inches; total length of the building, 350 feet. This building is designed with brick side and gable walls, with iron roof trusses and iron supporting columns. Originally built for an Iron Foundry, but, owing to the failure of the purchaser, is now offered for sale at a bargain. Is admirably adapted for a Foundry for light or heavy castings, Machine Shop, Car Barn, or for any other general manufacturing purposes. We guarantee the ironwork as good as new, the building never having been used.

Berlin Iron Bridge Company,
EAST BERLIN, CONN.

For Cutting Cast, Wrought Iron, Gas & Water Pipes.
THE ANDERSON PIPE CUTTER COMPANY, Manufacturers,
163 Liverpool st., E. Boston, Mass
N. Y. Office, 135 Greenwich St
C. H. Tucker, Jr., Manager.
WALDO BROS.,
102 Milk Street, Boston, Mass

The Gas Engineer's Laboratory Handbook.

By JOHN HORNBY, F.I.C. Price, $2.50.
A. M. CALLENDER & CO., 32 Pine St., N. Y. City.

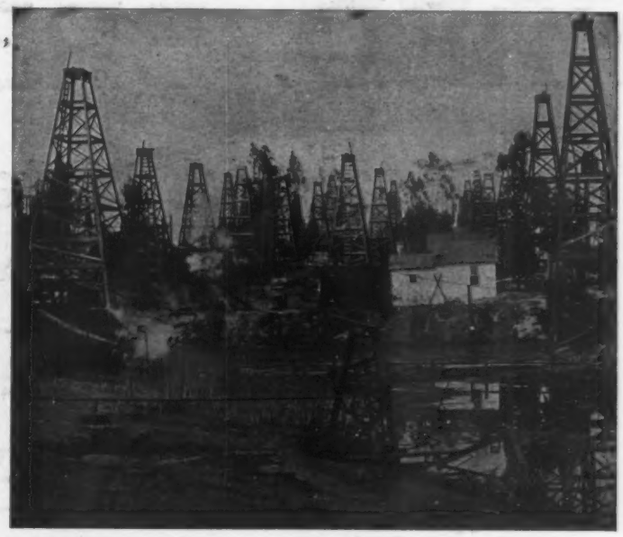
Gas Investments in California.

Nowhere else on this continent does such opportunity exist for profitable gas investment as on the Pacific Coast, since the perfection of the new LOWE Process for using the heavy crude California oils (of which there is an unlimited supply) without the use of any other fuels. Seven years' test proves the system to be perfect in every respect. Los Angeles alone, in addition to present street mains, has 150 miles of well built up streets without a gas main on them. To occupy this territory, and a large number of other towns now without gas, we have organized a parent company and a number of local companies covering some of the fastest growing cities in the United States.

Now is the time to invest, when the first capital will be able to double itself in a single year. This is also the most delightful residence section in the United States.

We suggest to those desiring gas investments, in large or moderate amounts—with or without active business connections—to come here and investigate; or, what is the next best thing, write us for particulars and prospectus.

The accompanying cut shows the oil wells in the suburbs of Los Angeles from which the Companies under the NEW LOWE GAS PROCESS obtain their supply of oil.



AMERICAN GAS & COKE CO. (T. S. C. Lowe, Manager),
406 Bradbury Building, Los Angeles, California.

THE GAS ENGINEER'S POCKET-BOOK.

By HENRY O'CONNOR.

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.

Price, - - - $3.50.

A. M. CALLENDER & COMPANY, No. 32 Pine Street, N. Y. City.

AMERICAN GAS COMPANY

Constructors of Coal Gas Apparatus.

KLONNE-BREDEL

Recuperative Furnaces, Washers, Condensers, Purifiers and Purifying Machines, Ammonia Plant, Coke Conveyers, Etc.

Complete Works Erected with Guaranteed Results.

EASTERN AGENTS FOR

FRED. BREDEL'S SYSTEM
COAL GAS PLANTS AND GAS APPARATUS.

P. H. & F. M. ROOTS CO.'S
Exhausters, Blowers, etc.

222 South Third Street, Philadelphia, Pa.

GEORGE G. RAMSDELL, General Manager. Correspondence Solicited

FRED. BREDEL, C.E.

Coal and Water Gas Plants,

OWN SYSTEM.

Recuperative Furnaces, Washers, Condensers, Purifiers, Purifying Machines.

Gas Enriching Plants to Enrich Coal Gas up to 24 Candle Power, and Making a White, Bright, Non-smoking Gas.

COMPLETE GAS WORKS, COKE CONVEYERS, ETC.

No. 118 Farwell Avenue, · · Milwaukee, Wis.

Eastern Agents: AMERICAN GAS CO., Construction Department, 222 So. 3d St., Phila., Pa.

ROOTS'

LATEST IMPROVED GAS EXHAUSTER

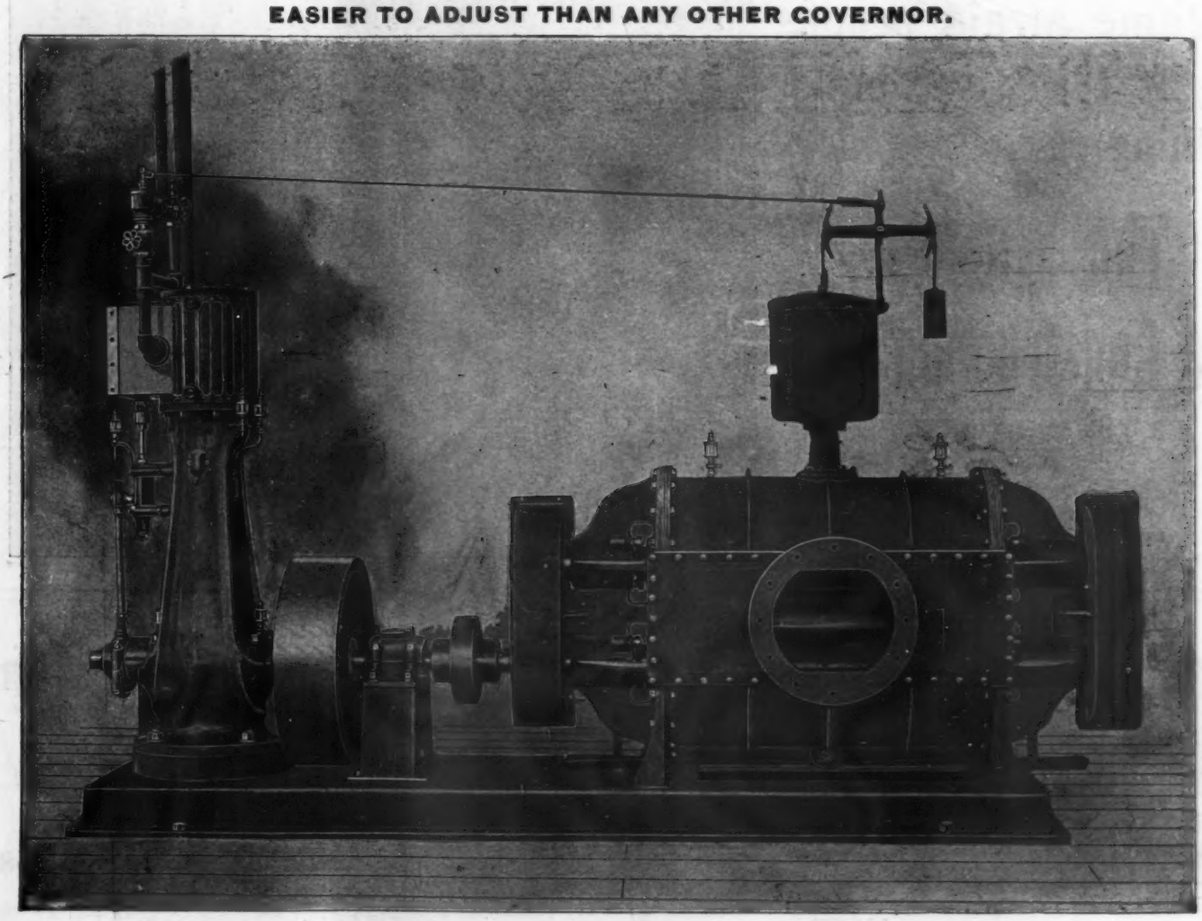
—AND—

NEW GAS GOVERNOR AND STEAM VALVE.

GUARANTEED TO REGULATE WITHIN ONE-TENTH OF AN INCH, WATER PRESSURE.

The Most Perfect Gas Governor on the Market.

MORE DIRECT IN ACTION. FEWER PARTS.
EASIER TO ADJUST THAN ANY OTHER GOVERNOR.



INQUIRIES CHEERFULLY ANSWERED. WRITE FOR CATALOGUE.

P. H. & F. M. ROOTS CO.,

Connersville, Ind. 109 Liberty St., New York.

Eastern Office:

American Gas Company,

222 South Third Street, Philadelphia, Pa.

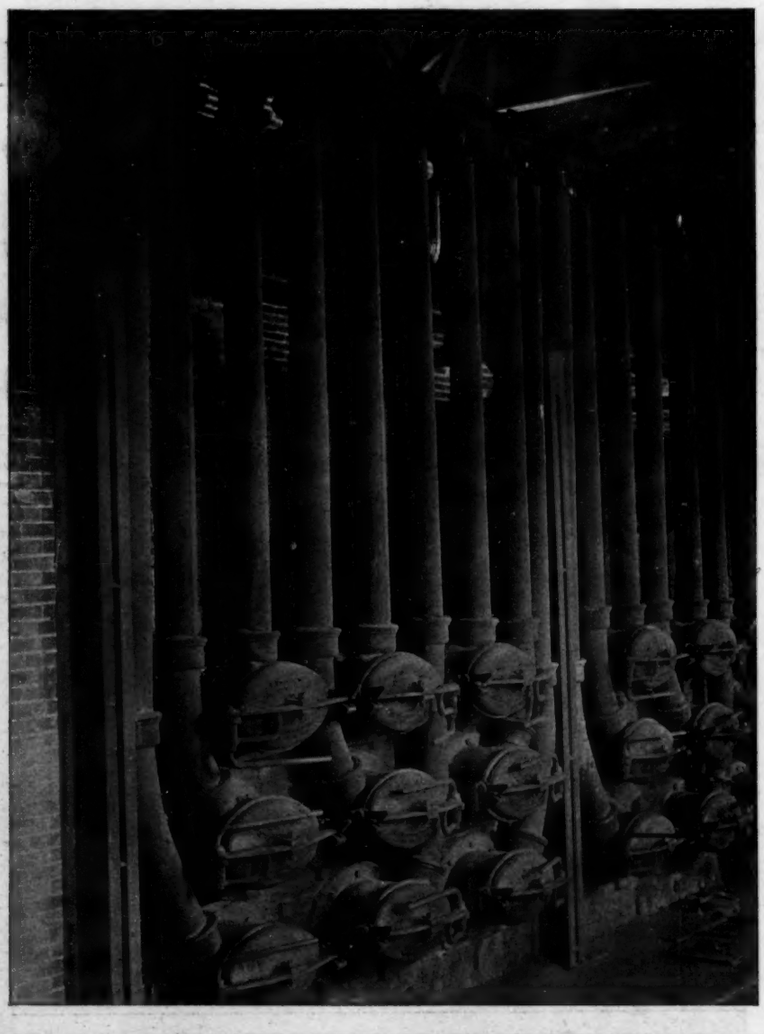
We show these just to remind you that we build them too.

We have on hand so many contracts for Improved Lowe Water Gas Apparatus, that we became afraid people might think we build nothing else.

The Western Gas Construction Co.,

FORT WAYNE, INDIANA.

WM. HENRY WHITE,
EASTERN AGENT,
32 Pine St., New York.



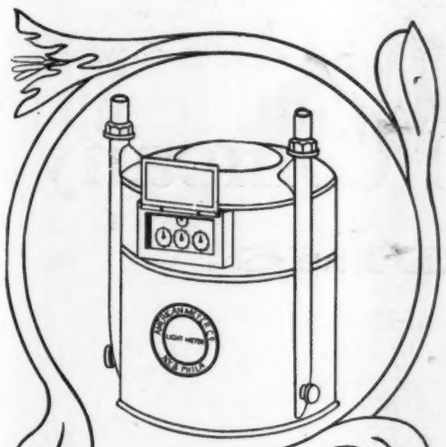
CHAPMAN VALVE MANUFACTURING CO.,
MANUFACTURERS OF
Valves and Gates for Gas, Ammonia, Water, Etc.
Also, Gate Fire Hydrants with and without Independent Nozzle Valve. All Work Guaranteed.
Works & Gen'l Office, Indian Orchard, Mass. Treasurer's Office, 72 Kilby & 112 Milk Sts., Boston, Mass.
Chicago Office, 24 West Lake St. New York Office, 28 Platt St.
St. Louis Office, L. M. Rumsey Mfg. Co., 810 North Second St.

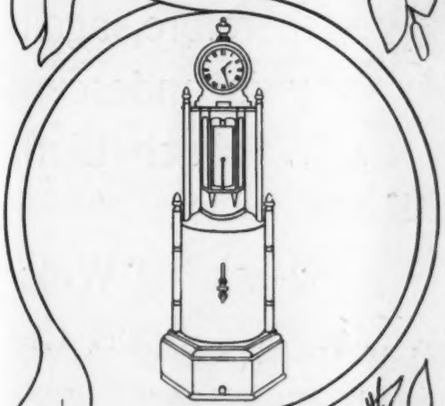
GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE
Plans prepared and Estimates furnished at short notice.
J. P. WHITTIER,
70 Rush St., Near Division Ave., **Brooklyn, N. Y.**

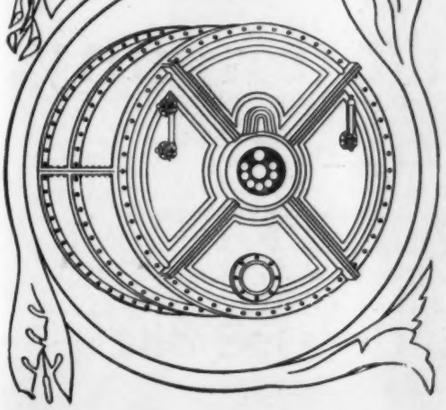
The Gas Engineer's Laboratory Handbook.
By JOHN HORNBY, F.I.C.
Price, $2.50.
A. M. CALLENDER & CO., 32 Pine Street, N.Y. City

THE
Ludlow Valve Mfg. Co.,
TROY, N. Y., U. S. A.
Double and Single Gate Valves, ¼" to 72",
—FOR—
Gas, Water, Steam, Oil, Ammonia, Etc.
HOT GAS VALVES A SPECIALTY.
Send for Catalogue.

Practical Photometry.
A GUIDE TO THE STUDY OF THE MEASUREMENT OF LIGHT.
By William Joseph Dibdin.
Price, $3.00.
A. M. CALLENDER & CO., 32 PINE ST., N. Y. CITY







(Copyrighted, 1894, by the AMERICAN METER CO.

AMERICAN METER CO.

ESTABLISHED 1834. INCORPORATED 1863.

NEW YORK AND PHILADELPHIA,

CHICAGO, ST. LOUIS,

SAN FRANCISCO.

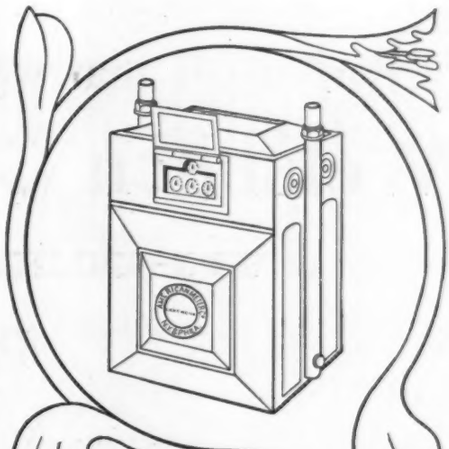
PUBLIC LIGHTING TABLE.

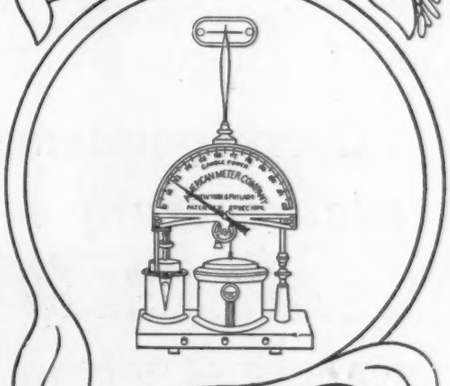
SEPTEMBER, 1898.

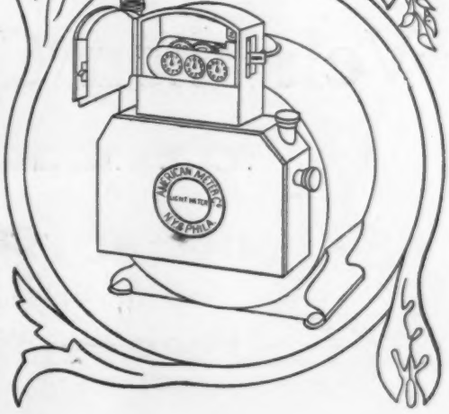
Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguist.
				P.M.	A.M.
Thu.	1	No L.	No L.	6.30	4.20
Fri.	2	7.00 PM	8.20 PM	6.30	4.20
Sat.	3	7.00	8.50	6.15	4.30
Sun.	4	6.50	9.20	6.15	4.30
Mon.	5	6.50	9.50	6.15	4 30
Tue.	6	6.50	10.30	6.15	4.30
Wed.	7	6.50 LQ	11.20	6.15	4.30
Thu.	8	6.50	12.10 AM	6.15	4.30
Fri.	9	6.50	1.10	6.15	4.30
Sat.	10	6.50	2.10	6.05	4.40
Sun.	11	6.40	3.10	6.05	4.40
Mon.	12	6.40	4.40	6.05	4.40
Tue.	13	6.40	4.40	6.05	4.40
Wed.	14	6.40	4.40	6.05	4.40
Thu.	15	6.40 NM	4.40	6.05	4.40
Fri.	16	6.40	4.40	6.05	4.40
Sat.	17	6.40	4.40	5.55	4.50
Sun.	18	6.30	4.50	5.55	4.50
Mon.	19	6.30	4.50	5.55	4.50
Tue.	20	7.30	4.50	5 55	4.50
Wed.	21	8.20	4 50	5.55	4.50
Thu.	22	9.20 FQ	4.50	5.55	4.50
Fri.	23	10.30	4.50	5.55	4.50
Sat.	24	11.40	4.50	5.40	5.00
Sun.	25	1.00 AM	4.50	5.40	5.00
Mon.	26	2.10	4.50	5.40	5.00
Tue.	27	3.20	4.50	5.40	5.00
Wed.	28	No L.	No L.	5.40	5.00
Thu.	29	No L. FM	No L.	5.40	5.00
Fri.	30	No L.	No L.	5.40	5.00

TOTAL HOURS LIGHTING DURING 1898.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	210.40	January	423.20
February	186.40	February	355.25
March	181.20	March	355.35
April	166.10	April	298.50
May	156.40	May	264.50
June	144.30	June	234.25
July	147.30	July	243.45
August	157.10	August	280.25
September	169.50	September	321.15
October	186.00	October	374.30
November	204.30	November	401.40
December	218.30	December	433.45
Total, yr.	2129.30	Total, yr.	3987.45







Welsbach Commercial Company,

DREXEL BUILDING,

PHILADELPHIA.

New Price Lists will be issued August 15th, 1898, and a New Catalogue about September 1st.

Correspondence from Gas Companies and the trade generally is solicited.

Suits brought by the Welsbach Light Company, under its patents, against the manufacturers of infringing lights and mantles, are still pending and undetermined. We, therefore, again caution the public against the purchase of any incandescent mantle other than that made and sold by the Welsbach Light Company or its agents.

Every genuine Welsbach lamp has the trade-mark "Welsbach" conspicuously printed upon the package and upon the burner itself.

Welsbach Commercial Company,

DREXEL BUILDING,

PHILADELPHIA.

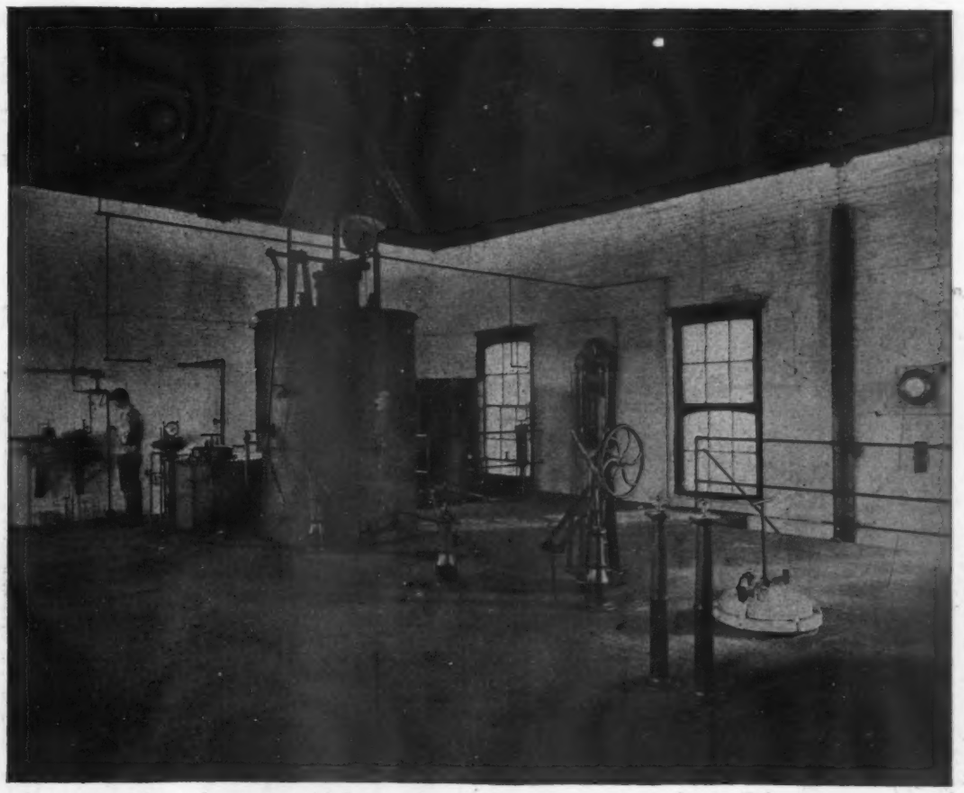
The United Gas Improvement Company,

DREXEL BUILDING, PHILA., PA.

The Standard Junior,

The Standard Double Superheater,

LOWE WATER GAS APPARATUS.



Total Built and under Construction,

288 Sets—Daily Capacity, 185,425,000 Cu. Ft.

ALEX. C. HUMPHREYS, M. E.,
BANK OF COMMERCE BUILDING,
(31 NASSAU STREET.)
NEW YORK.

CABLE ADDRESS,
LONDON & NEW YORK,
"HUMGLAS."

ARTHUR G. GLASGOW, M.E.,
9 VICTORIA ST.,
LONDON, S. W.,
ENGLAND.

HUMPHREYS & GLASGOW.

CONTRACTING AND CONSULTING

GAS ENGINEERS.

WATER GAS PLANT A SPECIALTY.
GAS PROPERTIES EXAMINED AND VALUED.
ADVICE AS TO IMPROVEMENT OF GAS PROPERTIES AND MANAGEMENT.

RITER-CONLEY COMPANY,

GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks.

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

GENERAL OFFICE: Pittsburg, Pa. EASTERN OFFICE: 39-41 Cortlandt St., New York City.

NEW YORK, 33 NASSAU ST. PHILADELPHIA, 1932 MARKET ST. CHICAGO, 54 LAKE ST.

WELSBACH STREET LIGHTING COMPANY

OF AMERICA,

—OWNS, CONTROLS AND OPERATES—

EXCLUSIVELY

THE NEW IMPROVED AND PATENTED

STREET LIGHT BURNER.

STYLE No. 81.

Our PATENTED "STREET LIGHT APPLIANCES" have made WELSBACH STREET LIGHTING a complete success.

By the UNIFORM DISTRIBUTION of light on scientific principles a greater area can be lighted by our system and more economically than in any other way.

Where there are no gas mains already laid, we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, enabling Gas Companies to furnish a uniform light in all localities.

Lists of Cities and Towns in which we are now lighting under contract will be furnished upon application.

STYLE No. 97.

CORRESPONDENCE SOLICITED FROM GAS COMPANIES AND OTHERS INTERESTED IN MUNICIPAL LIGHTING.

NATIONAL GAS AND WATER CO.,

218 La Salle Street, Chicago.

Builder and Operator of Gas Works.

The Rew Soft Coal Carbureted Water Gas Apparatus.

TESTED BY THREE YEARS' PRACTICAL OPERATION, AND FULLY GUARANTEED.

Plans and Estimates Upon Application.

IRWIN REW, President and Treasurer. E. E. MORRELL, Engineer.

CONNELLY IRON SPONGE AND GOVERNOR CO.,

(Successors to CONNELLY & CO.)

MANUFACTURERS OF GAS WORKS SPECIALTIES.

"IRON SPONGE." Saves money, saves labor, and is the most efficient purifying material ever offered as a substitute for lime. We guarantee a large saving, both in cost of material and labor.

AUTOMATIC GOVERNOR. OVER FOUR HUNDRED NOW IN USE! NO WORKS COMPLETE WITHOUT IT! WILL PAY FOR ITSELF WITHIN A YEAR! ITS SERVICE SECURES PERFECT DISTRIBUTION! REDUCES LEAKAGE TO MINIMUM, and BENEFITS THE COMPANY and CONSUMER ALIKE! IT IS THE ONLY RECOGNIZED AUTOMATIC GOVERNOR IN THE WORLD!

STEAM JET EXHAUSTER. Designed particularly for small works. Combines Exhaust Tube, Steam Governor, Gas Compensator and Bye-Pass Valves in the most compact form possible. Occupies but little space; uses very little steam; saves formation of carbon in retorts; increases yield 10 to 15 per cent. No works too small to use them profitably.

Prices given on all our specialties, delivered at any point in the United States. Correspondence solicited.

CONNELLY IRON SPONGE AND GOVERNOR CO., No. 357 Canal St., New York.

Hughes' "Gas Works,"

Their Construction and Arrangement,

And the Manufacture and Distribution of Coal Gas.

Originally written by SAM'L HUGHES, C.E.

Rewritten and Much Enlarged by WM. RICHARDS, C.E

Eighth Edition, Revised, with Notices of Recent Improvements.

Price, $1.65.

A. M. CALLENDER & CO., 32 Pine St., N. Y. City.

IRON MASS

For Gas Purification

Acts immediately, and more efficiently than any other purifying agent now in use.

GREENPOINT CHEMICAL WORKS,

Greenpoint Ave. and Newtown Creek, Brooklyn, N. Y.

The Chemistry of Illuminating Gas.

By NORTON H. HUMPHRYS. Price, $2.40.

A. M. CALLENDER & CO., 32 PINE ST., N. Y. CITY.

ONEILL'S OXIDE,

(NATURAL BOG ORE)

For Gas Purification.

Has the Largest Annual Sale of Any Oxide in the World.

GAS PURIFICATION AND CHEMICAL CO., LTD.,

160, 161, 162 Palmerston Buildings,

Old Broad St., London, E. C., Eng.

Parson's Steam Blower,

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREZEE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER,

FOR USING COAL TAR AS FUEL.

PARSON'S AIR JET TUBE CLEANER,

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial*. No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.

H. E. PARSON, Supt., 67 Bremen Street, Brooklyn, N. Y.

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING:

Ocean Mine Youghiogheny Gas Coal,
Old Kentucky Shale and O. K. Boghead.

SHIPMENTS FROM NEW YORK, PHILADELPHIA, BALTIMORE AND NORFOLK.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

Offices:
Washington Building, New York.
Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully prepared.
For Gas Making or
Heavy Steaming.

SCIENTIFIC BOOKS.

TECHNICAL GAS ANALYSIS. $3.

GAS CONSUMER'S HANDYBOOK, by Wm. Richards, C.E. 20 cents.

CHEMISTRY OF ILLUMINATING GAS. By Norton H. Humphrys. $2.40.

PRACTICAL TREATISE ON HEAT By Thomas Box. 2d edition. $5.

PRACTICAL PHOTOMETRY: A Guide to the Study of the Measurement of Light. By W. J. Dibdin. $3.

CHEMICAL TECHNOLOGY: Vol. I., *Fuel and Its Applications*, $5. Vol. II., *Lighting*, $4.

IRONWORK: Practical Designing of Structural Ironwork. By H. Adams. $3.50.

GAS WORKS: Their Arrangement, Construction, Plant and Machinery. $5.

PRACTICAL HANDBOOK ON GAS ENGINES, by G. Lieckfield. $1.

LIQUID FUEL FOR MECHANICAL AND INDUSTRIAL PURPOSES. By E. A. Brayley Hodgetts. $2.50.

COAL, SPONTANEOUS COMBUSTION OF. By Thomas Rowan, C.E. $2.

COAL: Its History and Use. By Prof. Thorpe. $3.50.

THE GAS WORKS OF LONDON. By Colburn. 60 cents.

HEAT A MODE OF MOTION. By John Tyndall. $2.50.

THEORY OF HEAT. By J. Clerk-Maxwell. $1.50.

THE MANAGEMENT OF SMALL GAS WORKS. By C. J. R. Humphreys. $1.

MANUAL FOR GAS ENGINEERING STUDENTS. By D. Lee. 40 cents.

GASFITTER'S GUIDE, by John Eldridge 40 cents.

AMMONIA AND AMMONIUM COMPOUNDS. By Dr. R. Arnold. $2

CONSTRUCTION OF GAS WORKS, by Walter Ralph Herring. $2.

DIGEST OF GAS CASES. $5.

PRACTICAL HINTS ON REGENERATOR FURNACES By M. Graham. $1.25.

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR. By Geo. Lunge. New edition. $12.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS. By D. A. Graham. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY. By Prof. Victor Von Richter. $2.

ILLUMINATING AND HEATING GAS. By W. Burns. $1.50

HANDBOOK FOR MECHANICAL ENGINEERS. By H. Adams. $2.50.

TREATISE ON MASONRY CONSTRUCTION. Baker. $5

GAS ENGINEER'S LABORATORY HANDBOOK. By Jno. Hornby, F.I.C. $2.50.

GAS LIGHTING AND GAS FITTING. By W. P. Gerhard. 50 cents.

PRACTICAL PLUMBING. By P. J. Davies. $3.

GAS MANUFACTURE, THE CHEMISTRY OF, by W. J. A. Butterfield. $3.50.

AMERICAN PLUMBING. By Alfred Revill. $2.

CEMENT; A Manual of Lime and Cement, their Treatm and Use in Construction. By A. H. Heath. $2.50.

ELECTRICITY.

INDUSTRIAL PHOTOMETRY, with Special Application to Electric Lighting. By A. Palaz, Sc.D. $4.

ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage and Distribution. By Philip Atkinson. $1.50.

ELECTRIC TRANSMISSION OF ENERGY. By G. Knapp. $3.50.

ELECTRICIAN'S POCKETBOOK. By Monroe and Jamieson. $2.50.

MAGNETISM AND ELECTRICITY. By J. Overend. 40 cts

DYNAMO BUILDING. By F. W. Walker. 50 cents.

DOMESTIC ELECTRICITY FOR AMATEURS. By E. Hospitalier. $2.50.

PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS. $1.

PRACTICAL GUIDE TO THE TESTING OF INSULATE WIRES AND CABLES. $1.

ELECTRIC LIGHTING, by Francis B. Crocker, E.M. $3.

ELECTRIC LIGHT FITTING. $2.

PRACTICAL ELECTRICITY. $2.50.

ELECTRICITY FOR ENGINEERS. $2.50.

ELECTRICITY, Its Theory, Sources and Applications. By John T. Sprague, M.I.E.E. $6.

The above will be forwarded upon receipt of price. If sent by mail or express, postage or express charges must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order No books sent C.O.D.

A. M. CALLENDER & CO., 32 Pine Street, New York.

The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

DESPARD GAS COAL,

AND MANUFACTURERS OF

COKE.

MINES, - - Clarksburgh, Harrison Co., West Va.
WHARVES, - - - Locust Point, Baltimore, Md.
OFFICE, - 640 Equitable Building, Baltimore, Md.

ROUSSEL & HICKS, 71 Broadway, N. Y. } *AGENTS,* { BANGS & HORTON, 60 Congress St., Boston.

W. D. ALTHOUSE & CO.

Reading Terminal—Philadelphia.

"Shaner," Westmoreland, Pa.

HIGH GRADE GAS COAL
AND
KENTUCKY CANNELS.

KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited.

GREENOUGH'S "DIGEST OF GAS CASES."

Price, $5.00.

This is a valuable and important work, a copy of which should be in the possession of every gas company in the country, whether large or small. As a book of reference it will be found invaluable. It is the only work of the kind which has ever been published in this country, and is most complete. Handsomely bound. Orders may be sent to

A. M. CALLENDER & CO., 32 Pine St., N. Y.

— THE —

PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened and Prepared for Gas Purposes.

Their property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

Room 720, Reading Terminal Building, Phila., Pa.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River: Pier No 1 (Lower Side), South Amboy, N. J.

EDMUND H. McCULLOUGH, Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.,
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

THE SUN OIL CO.

Crude Oil, Gas Naphtha,
Refined Petroleum, Gas Oil.

Toledo, O., and Pittsburgh, Pa.

Standard Oil Company,

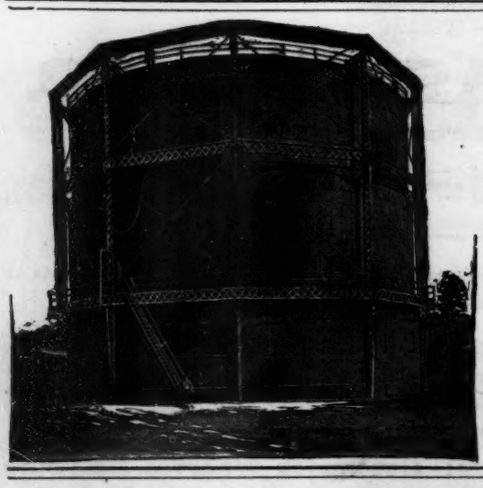
GAS NAPTHA DEPARTMENT.

GAS NAPTHA.

GAS OIL.

Correspondence Solicited.

26 Broadway, New York City.



DAVIS & FARNUM MFG. CO.,

WALTHAM, MASS.

Principal Office & Works, Waltham, Mass. Boston Office, R'm 18, Vulcan Bldg., 8 Oliver St.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

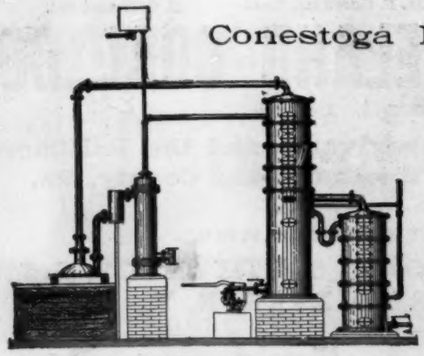
Coke Borrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

GAS ENGINEERING COMPANY.

INCORPORATED,

Conestoga Building, PITTSBURGH, PA.



AMMONIA MACHINE.

MANUFACTURERS OF

Gas Works Machinery of all kinds,

PATENTEES AND OWNERS OF

PITTSBURGH WASHER-SCRUBBER,

SOLE AGENTS FOR

FELDMANN AMMONIA MACHINE,

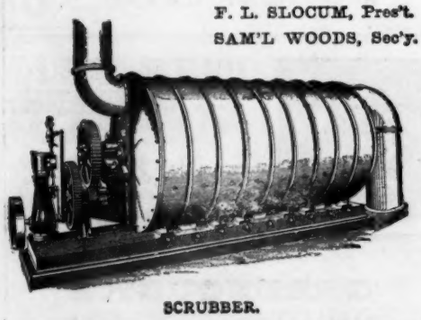
For producing Sulphate, Aqua, Chloride and Concentrated Liquors.

The Erection of Bi-Product Coke Ovens a Specialty.

Faux System of Recuperative Benches.

NEW SYSTEM HYDRAULICS.

F. L. SLOCUM, Pres't.
SAM'L WOODS, Sec'y.



SCRUBBER.

Kerr Murray Manufacturing Company,

Steel Gasholder Tanks,

SINGLE, DOUBLE AND TRIPLE-LIFT GASHOLDERS,

HORIZONTAL AND VERTICAL STORAGE OIL TANKS

Iron Work for Coal Gas Benches, Self-Sealing Mouthpieces, Exhausters, Condensers, Scrubbers, Purifiers, Wooden Trays, Floor Carriages, Center Seal and Valve System Connections, Cast and Wrought Iron Fittings, and Connections 3 to 36 Inches Diameter.

VALVES, Double Gate, Hub and Flange, Outside Screw and Quick Opening, 3 to 36 In. Diam.

COAL AND COKE WAGONS, RETORT HOUSE TOOLS, STREET MAIN SPECIALS AND DRIPS.

Address,

KERR MURRAY MANUFACTURING CO.

Fort Wayne, Indiana.

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Triple, Double and Single-Lift Gasholders.

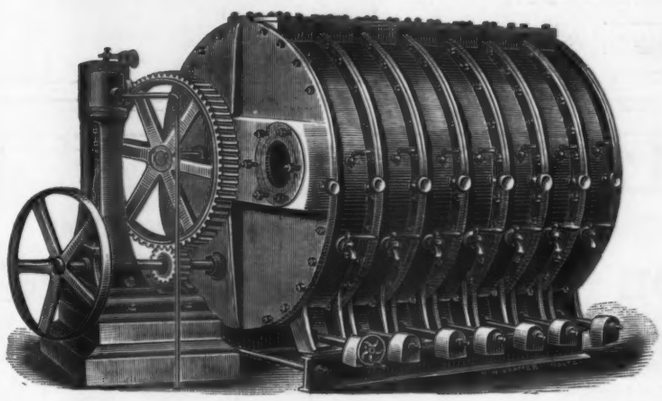
Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS

PURIFIERS.



CONDENSERS.

Scrubbers.

Bench Castings.

OIL STORAGE TANKS

Boilers.

PATENT STANDARD WASHER-SCRUBBER.

The best apparatus for the extraction of all Ammonia and a large proportion of Carbonic Acid and Sulphureted Hydrogen. The Scrubber has been materially improved and is provided with patented Wooden Segmental Grids, instead of Metallic Discs, thus reducing the weight on shaft and power for operating same.

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSIBLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

MILL'S REVERSIBLE LIME TRAYS.

Gas Works Designed and Constructed.

POOLE ON FUELS.

THE CALORIFIC POWER OF FUELS.

WITH A VERY FULL COLLECTION OF TABLES OF HEATS OF COMBUSTION OF FUELS, SOLID, LIQUID AND GASEOUS.

TO WHICH IS ALSO APPENDED

THE REPORT OF THE COMMITTEE ON BOILER TESTS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS DECEMBER (1897); TABLES OF CONSTANTS USED.

By HERMAN POOLE, F.C.S.

FIRST EDITION.

Price $8. For Sale by

A. M. CALLENDER & CO. - - No. 32 Pine Street, New York City.

R. D. WOOD & CO.,

ENGINEERS, IRON FOUNDERS, MACHINISTS.

400 Chestnut Street, Philadelphia, Pa.

MANUFACTURERS OF

CAST IRON PIPE.

BUILDERS OF

Gas Holders,

Single, Double and Triple Lifts, with or without Wrought Iron or Steel Tanks.

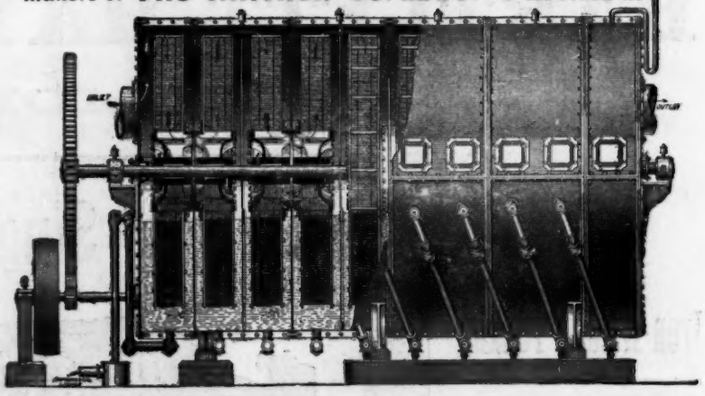
PURIFIERS, CONDENSERS, SCRUBBERS.

The Hopper Automatic Gas Governor

Send for Pamphlet.

Dunham Patent Specials.

Sole Makers of **The Mitchell Scrubber Patented.**



ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

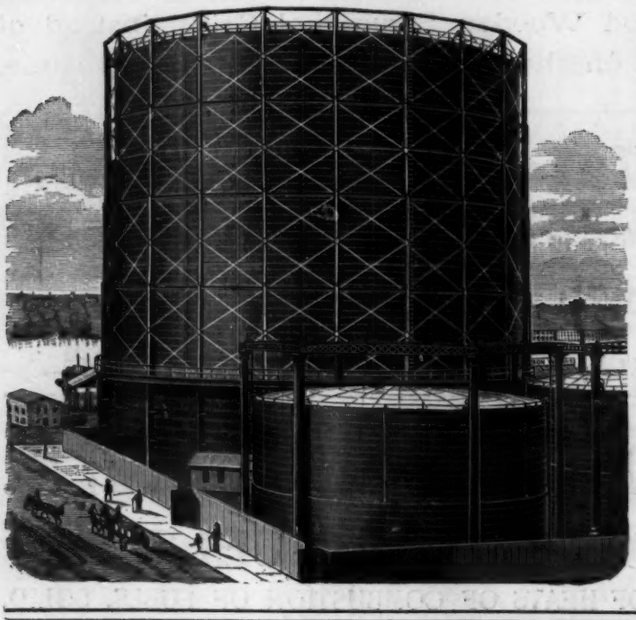
FOUNDERS AND MACHINISTS.

MANUFACTURERS OF

All Ironwork and Machinery Required in a Gas Plant.

Estimates, Drawings and Specifications furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

245 Broadway, New York City. OFFICES **Bridge & Ogden Sts., Newark, N. J.**



The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, Jr., Secretary & Treasurer.

West and Calyer Sts. (Near 10th & 23d St. Ferries)
NEW YORK, Borough of Brooklyn.

BUILDERS OF

Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

STEEL GAS HOLDER TANKS.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc.

Self-Sealing Retort Mouthpieces & Lids

For Round, Oval, or "D" Retorts.

ILLUMINATING GAS! FUEL GAS!

THE LOOMIS PROCESS.

Now in successful operation at Works of John Russell Cutlery Co., Turner's Falls, Mass., and Henry Disston's Son's Saw Works, Tacony, Pa.

The Cheapest Gas Generating System in the World.

Plans and Estimates Furnished.

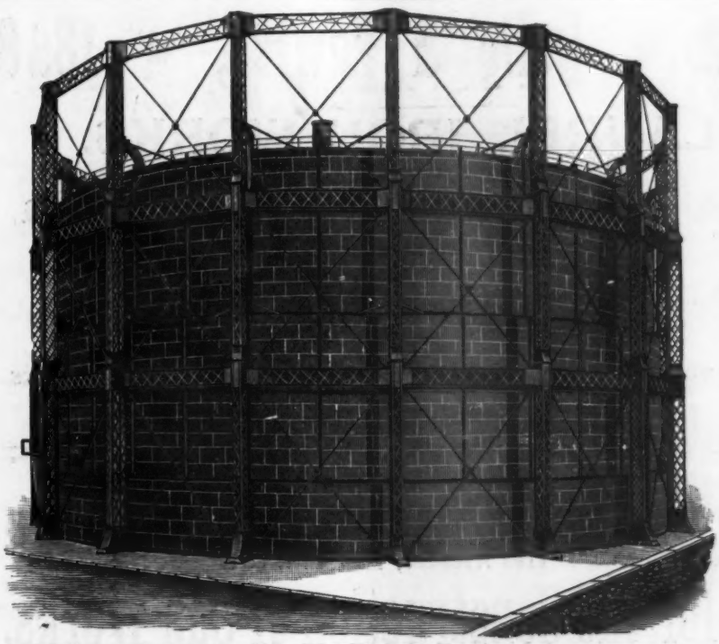
BURDETT LOOMIS, - - Hartford, Conn.

To Gas Companies.

We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,
948 N. 8th St., Phila., Pa



H. RANSHAW, Prest. & Mangr. T. H. BIRCH, Asst. Mangr
WILLIAM STACEY, Vice-Prest. R. J. TARVIN, Sec. & Treas.

THE STACEY MANUFACTURING CO

Established 1851.

Single, Double and Triple-Lift

GASHOLDERS,

Of any Capacity, with or without Wrought Iron or Steel Tanks.

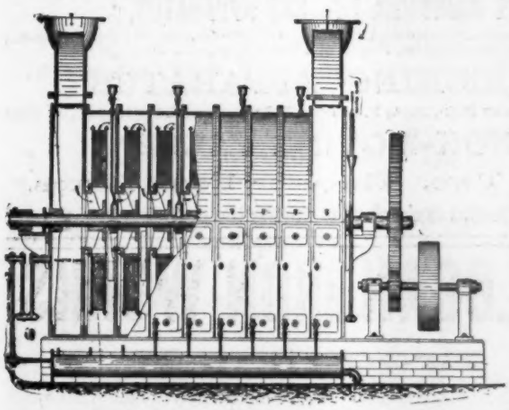
Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, etc.

Coal Gas Benches, Roof Frames,

OIL STORAGE TANKS.

Pressed Steel Mouthpiece Lids, Self-Sealing Mouthpiece Lids.

Cincinnati, Ohio.



GEORGE SHEPARD PAGE'S SONS,

AGENTS FOR

The Ammonia Washer-Scrubber

The Ammonia Scrubber (late "Standard") has been before the American Gas Engineers for the past nineteen years. During that time many improvements have been made by the builders, the Isbell-Porter Company, until to-day it stands at the head of all Scrubbers. The fact of there being nearly ninety in use, with a combined capacity of 70,000,000 cubic feet per 24 hours, is of itself sufficient indorsement of its merit. There is no other Scrubber built giving so little back pressure and so much area per thousand cubic feet. Do not be induced to put in a Scrubber until you have acquainted yourself with the AMMONIA SCRUBBER.

Write for Circulars and Blue Prints.

69 Wall Street, = = New York City.

GEORGE R. ROWLAND.

Formerly with the Continental Iron Works.

Draughtsman and Constructing Engineer.

Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.

Office, No. 245 Broadway, N. Y. City.

W. H. PEARSON, Prest. J. W. WESTCOTT, Gen'l Mangr. and Treas. L. L. MERRIFIELD, Chief Engr.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, Limited

269 Front Street, East, Toronto, Canada.

ENGINEERS AND BUILDERS OF THE **IMPROVED LOWE WATER GAS APPARATUS.**

Designed to give the Greatest Efficiency when using any kind of Oil, Anthracite Coal, Gas House or Oven Coke.

New Gas Works Built, Present Gas Plants, either Coal or Water, Remodeled

Catalogues, Plans and Estimates Furnished upon Application.

WM. HENRY WHITE,

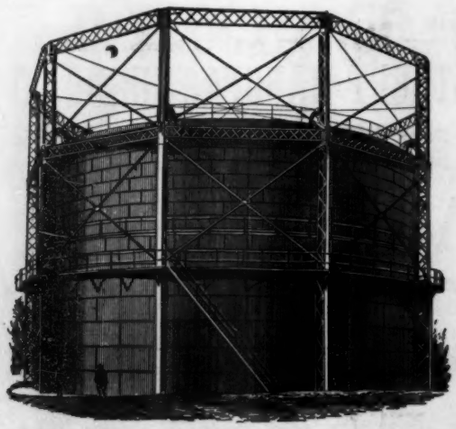
No. 32 Pine Street, - - - New York City.

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited. Plans and Estimates Furnished.



1842 * Deily & Fowler, * 1898

LAUREL IRON WORKS.

Office, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS, WATER TANKS, AND GENERAL WROUGHT IRON WORK.

JAMES R. FLOYD'S SONS,

Successors to HERRING & FLOYD,

Oregon Iron Works,

West 20th and 21st Streets, Between 10th & 11th Avenues, New York City.

Engineers and Contractors for the Construction of Gas Works.

MANUFACTURERS OF ALL KINDS OF CASTINGS AND GENERAL IRONWORK FOR GAS APPARATUS.

Bench Castings, Regenerative and Half Regenerative Furnace Castings, Condensers, Tower Scrubbers, Mechanical Scrubbers, Purifiers, Malleable Iron Retort Lids, Self-Sealing Retort Lids, Hydraulic Hoist Purifier Carriage, Crosses, Tees, Bends, Angles, Reducers, S-Bends, Sectional Sleeves, Plugs, Caps, Street Drips, etc., always on hand.

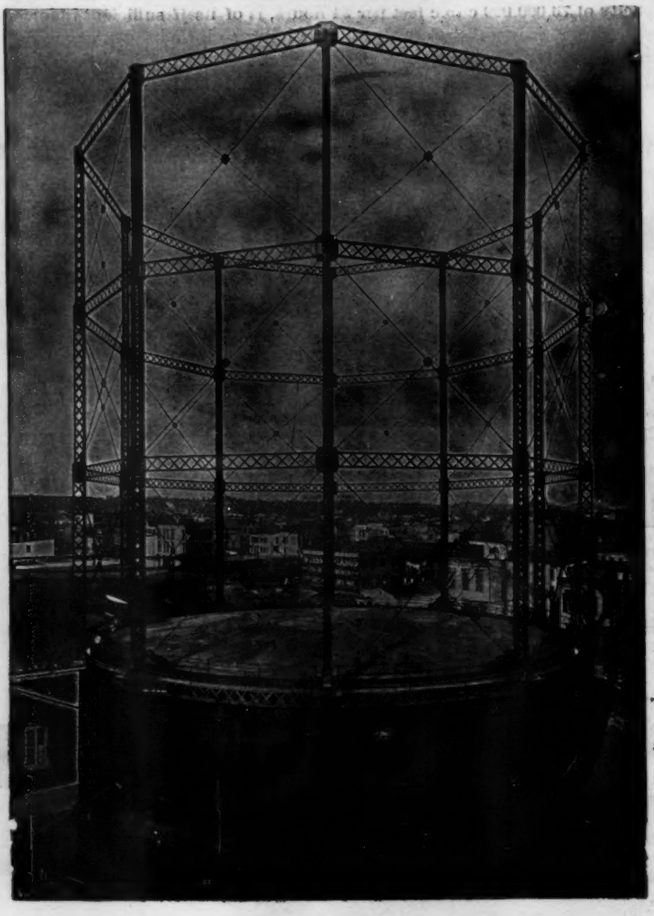
WOOD'S GAS SCRUBBING AND ENRICHING APPARATUS.

In use at Syracuse, Auburn, Watertown, Cortland and Geneva, N.Y.; Elizabeth, N. J.; Boston, Mass.; Jamaica Plain, Mass.; Providence, R. I.; Northern Liberties Gas Co., Phila

Sole Manufacturers of the OGDEN QUICK-MOVING VALVE.

HEARNE CENTER SEAL, Operating One, Two, Three or Four Boxes.

Stroh & Osius Concentrator for Ammoniacal Liquor, used by 50 Gas Companies and Cokeries during the past 4 years.



The order for this Triple-Lift Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 Cu. Ft.

LOGAN IRON WORKS,

Brooklyn, N. Y.

MANUFACTURERS OF

Single or Multiple-Lift

GASHOLDERS,

Complete with Steel Tanks.

BENCHES, SCRUBBERS,

CONDENSERS,

PURIFIERS, IRON ROOFS,

Self-Sealing Retort Lids,

AND ALL PARTS OF

GAS WORKS APPARATUS

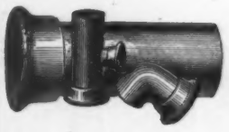
Contractors for Complete Works.

ALSO, SOLE MANUFACTURERS OF

C. W. BLODGET'S

HOT GAS SCRUBBER.

THE OHIO PIPE COMPANY,
MANUFACTURERS OF
Cast Iron Gas & Water Pipe,
BRANCH AND SPECIAL CASTINGS.
Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.
GENERAL FOUNDERS AND MACHINISTS
Columbus, Ohio.

WARREN FOUNDRY AND MACHINE CO.,
Established 1856. Works at Phillipsburgh, N. J.
New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,
FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF
Flange Pipe for Sugar House and Mine Work. Branches. Bends, Retorts, etc., etc

DAVID LEAVITT HOUGH,
26 CORTLANDT ST., N.Y. CITY.
Consulting Engineer.
Investigations and Appraisals.
Designs and Estimates.
Contractor.
Machinery and Structures.
Gas and Water Pipe.
Special Agent for Selling & Purchasing.

"GLOBE" SPECIALS, VALVES, ETC. "GLAMORGAN" FIRE HYDRANTS
M. J. DRUMMOND & CO.
MANUFACTURERS OF
CAST IRON
FLANGE
GAS & WATER PIPE
GENERAL SALES OFFICE, 192 BROADWAY, NEW YORK.
Western Office: Monadnock Block, Chicago, Ills.

GEORGE ORMROD, Manst. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa
EMAUS PIPE FOUNDRY.
DONALDSON IRON COMPANY. EMAUS, PA

MANUFACTURERS OF
CAST IRON PIPE AND SPECIAL CASTINGS
FOR WATER AND GAS.
Also, FLANGE PIPE, LAMP POSTS, Etc.

Practical Hints
ON THE CONSTRUCTION AND WORKING OF
Regenerator Furnaces,
By MAURICE GRAHAM, C.E.
Price $1.25.
A. M. CALLENDER & CO., 32 Pine Street, N.Y.

CHARLES MILLAR & SON, Selling Agents, Utica, N. Y.
Flanged Pipe and Fittings, Hydrants, Gates, Pig Lead, Jute, etc.

Manufacturers of Lead Pipe, Solder, etc., and Jobbers of Plumbers' and Tinners' Goods.
CAST IRON PIPE and SPECIALS FOR WATER AND GAS.
Wholesale Eastern Agents AKRON VITRIFIED SEWER PIPE.

Established 1854.
D. McDONALD & CO.,
MANUFACTURERS OF
WET AND DRY METERS, STATION METERS AND METER PROVERS.
—ALSO MAKERS OF
THE GLOVER PREPAYMENT METER.

The amount of gas delivered for the coin can be instantly and positively changed without removing the meter or replacing any parts.

The gas registered agrees absolutely with the amount purchased by the coin.

WE HAVE MADE AND SOLD IN THE UNITED STATES
OVER 30,000 OF THESE METERS,
ALL OF WHICH ARE GIVING PERFECT SATISFACTION.
Correspondence Solicited.

511 West Twenty-first Street, NEW YORK. | 51, 53 & 55 Lancaster Street, ALBANY, N. Y. | 34 & 36 West Monroe Street, CHICAGO.

Established 1849. With the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS METER CO.,

63 Beverly Street, Boston, Mass.

MANUFACTURERS OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Apparatus for the Chemical Testing of Gas and Gas Liquor.

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

THE MARYLAND METER AND MANUFACTURING CO.

Established 1866.

BALTIMORE, North & Saratoga Sts. **CHICAGO, 107 West Monroe St.**
NEW YORK, 838 Broadway. **SAN FRANCISCO, 221 Front St.**

CONSUMERS' & STATION METERS, PRESSURE GAUGES, Etc., Etc.

"Perfect" Gas Stoves

METRIC METAL COMPANY,

MAKERS OF

GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes.

FACTORY AT ERIE, PA.

The KEYSTONE METER CO.

Gas Meters

That Satisfy

ROYERSFORD, PA.

American Meter Co.

NEW YORK, PHILADELPHIA,
SAN FRANCISCO.

Prepayment Meters.

Their construction is such that they may be readily readjusted when the scale of gas rates is changed.

HELME & McILHENNY,

Established 1848. **1339 to 1349 Cherry Street, Philadelphia, Pa.**

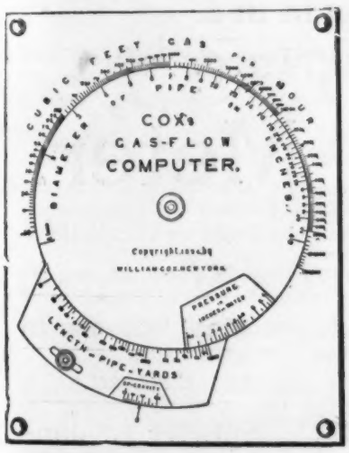
MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Our Own Patents. Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED.



Do you wish to Know

what size of Pipe to use to convey any quantity of Gas, any distance, with any loss of pressure, and any initial or final pressure? Then use

COX'S GAS FLOW COMPUTER,

as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.

Price, 6.5 x 8 inches, in cloth case, $2.50.

For sale by

A. M. CALLENDER & CO., 32 Pine St., N. Y. City.

THEODORE D. BUHL, President. CHARLES H. JACOBS, Secretary-Treasurer.

Detroit Meter Company,

DETROIT, MICH.

Manufacturers of . .

GAS METERS of the HIGHEST QUALITY

METER REPAIRING A SPECIALTY. SEND FOR OUR PRICE LIST.

Detroit is one of the best shipping points in the United States for prompt deliveries by rail or water to the East, West or South.

BUHL Meters will need few Repairs. We make our own Tin Plate. Trial Orders Solicited.

The Advertisement of the

OTTO GAS ENGINE WORKS,

33d and Walnut Streets, Philadelphia,

New York, 39 Cortlandt St., Boston, 19 Pearl St., Chicago, 245 Lake St.,

Occupies this space every alternate week.

JOHN J. GRIFFIN & CO.,

1513-1515-1517-1519-1521 Race Street, Philadelphia.

52 Dey Street, New York. WM. S. GRIBBEL, Manager.

75 N. Clinton St., Chicago. FREDERICK WAUGH, Manager.

MANUFACTURERS OF

STATION METERS, CONSUMERS' METERS,

Provers, Registers, Gauges, Experimental Apparatus, Etc.

Prompt Attention Given to All Repairing.

OUR SPECIAL NATURAL GAS METER

Is the Best ever offered. Over 30,000 now in use.

We manufacture in the United States, under the **SAWER & PURVES PATENTS,** the

Positive Prepayment Meter.

. . SIMPLE . .

. DURABLE .

. ACCURATE .

. RELIABLE .

All Parts Interchangeable

This Meter is an unqualified success in Great Britain. Its simplicity of construction, and the positive character of the service performed by it, have given it pre-eminence.

Needs Only the Care Given an Ordinary Meter.

Saves MONEY, TIME and CONSUMERS.

Dispenses with "DEPOSITS" and Increases OUTPUT.